MODERN PLASTICS

m
p

OCTOBER 1943



How the future will look to your secretary!

DAVE CHAPMAN
Industrial Designer

ASIDE from her dreams of flying in a helicopter ... how will the future affect your secretary's daily life? It's our guess that there will be just as many letters to get out every day. But with a difference!

When you replace her typewriter after the war ... it's likely the model you buy will conform to the ideas rendered here by Mr. Chapman. For he says...

"This particular design is based upon electrical operation. Thus the travel of the keys would be a scant eighth of an inch. Ask any girl, who really has to pound a typewriter all day, what this saving in effort and energy would mean to her efficiency. The carriage, spacer, and 'cap' key are also electrically operated. And the machine is lighted from within so that the vagaries of office lighting do not have to be depended upon. The housing and keys, as well as many working parts, would be molded of Durez plastics. *And why?* First, they offer substantial reductions in weight. Second, Durez plastics are non-reverberating so they will not transmit machine noises in operation. And third, they offer the manufacturer real mass-production economies."

We wish we could tell you when such typewriters will come on the market. But we can tell you Durez plastics are doing their full share, serving our fighting men who are speeding the day when we can return to a peacetime economy. Durez Plastics & Chemicals, Inc., 230 Walck Road, North Tonawanda, N. Y.

DUREZ

PLASTICS THAT FIT THE JOB

★ BUY UNITED STATES WAR BONDS AND STAMPS ★



thermal properties

Since a plastic material, through design, translates itself into a plastic product . . . it is important to consider the Thermal properties of such materials in advance of adoption, for they dictate the maximum temperatures and service limitations to which the plastic can be subjected.

The heat conductivity of a material is a measure of its insulating value, the lower the conductivity the greater the insulation. Obviously the best conductor is the poorest insulator. Temperature may cause changes in physical dimensions because of softening; it may increase creep and cold flow. It might also cause volitalization of the plasticizer in thermoplastic products. The heat distortion point serves as a guide. Thermal expansion and shrinkage in service are particularly important when combining plastics and metals. Differences in the expansion of metal and plastic may cause cracking. Shrinkage in service of Catalin Cast Resins is only (.00018 in. per in.). Flammability and the effect of hot flames are necessarily a part of the complete story. Many plastic materials may be classed as non-inflammable, but when they come in direct contact with fire, they melt and flow. "Catalin" however, will only char slowly. It does not melt or flow when brought into the path of hot flames.

All Catalin plastics have excellent thermal properties. However, there are many formulations available. When listing these properties a material manufacturer covers a wide range. The heat distortion point of the many formulations of "Catalin" Cast Resins and "Loalin", our Polystyrene molding compound, varies from 104°F. to 194°F. If the maximum value of any one property is desired, the designer cannot rely on having maximum values for other properties. Frequently, one property has to be sacrificed to achieve another. When confronted with a specific problem, it is wiser to consult a material manufacturer. For current wartime applications and for planning now for the mass production that shall come with the peace, "Catalin" technicians will gladly share their knowledge and experience with your staff.

Cast Resins
Molding Compounds
Liquid Resins

CATALIN
CORPORATION

ONE PARK AVENUE • NEW YORK 16, N. Y.

ONE · OF · A · SERIES · ON · THE · PHYSICAL · PROPERTIES · OF · PLASTIC · MATERIALS

Modern Plastics

VOLUME 21 OCTOBER 1943 NUMBER 2

GENERAL INTEREST

No blowouts for barrage balloons 69
Automotive techniques in war 72
"Eyes" of the tank 75
Behind the scenes 80
Resin-bonded plywood tubing 81
Night into day 83
Fasteners for Army insignia 86
Soap's rôle in the plastics industry 87
Architectural League exhibit 136

PLASTICS ENGINEERING

Transparent enclosures in aircraft 89
The blowing of plastics 96
Vertical speed indicator 100

TECHNICAL SECTION

Toughness of molding materials 103
Evaluation of high-strength plastics 107
American Chemical Society meeting 110
Technical briefs 114
Plastics digest 116
U.S. plastics patents 118

NEWS AND FEATURES

Product development 78
Plastics in review 84
Machinery and equipment 122
Publications 124
Washington round-up 126
In the news 130
Society of the Plastics Industry 134
London letter 138

Editor CHARLES A. BRESKIN
Managing Editor HARRIET B. JOSEPHS
Technical Editor DR. GORDON M. KLINE
Engineering Editor FRED B. STANLEY
Associate Editor DOROTHY MARTIN
Associate Editor LAURA E. MORRISON
Washington Editor R. L. VAN BOSKIRK
Readers' Service EDNA SILEN
Art Director JOSEPH BOLOGNA

BUSINESS STAFF

ALAN S. COLE, General Manager

P. H. BACKSTROM M. A. OLSEN

DANIEL M. BROADS Production
R. G. GERMAISE Circulation
WALTER S. ROSS Promotion

J. M. CONNORS
221 N. La Salle St. Chicago 1, Ill.

R. C. BEGGS
815 Superior Ave. Cleveland 14, Ohio

L. B. CHAPPELL
427 West 5th St. Los Angeles 13, Calif

● All editorial contents having bearing on military subjects have been released for publication in MODERN PLASTICS by the Armed Services.

Member Audit Bureau of Circulations

ABC

EXECUTIVE and EDITORIAL OFFICES: 122 E. 42nd St., New York 17, N. Y. WASHINGTON 6, D. C., OFFICE: 625 Colorado Bldg., 14th & G Sts.

Published the 5th of each month by Modern Plastics, Incorporated. Publication Office, Twentieth and Northampton Sts., Easton, Pa. Subscription price $5.00 per year, $8.00 for 2 years in U. S., its possessions and South America. Canadian subscriptions $5.50 per year, $9.00 for 2 years; all other countries $6.00 per year, $10.00 for 2 years, payable in American money or its equivalent. Price 50¢ per copy. Copyright 1943 by Modern Plastics, Inc. All rights reserved. Printed in U. S. A. Entered as second class matter May 28, 1940, at the Post Office at Easton, Pa., under the act of March 3, 1879. Member of the Audit Bureau of Circulations. Back numbers 3 months or more preceding current issues, when available, $1.00 each. Modern Plastics is fully protected by copyright and nothing that appears in it may be reprinted, wholly or in part, without special permission.

UNIFORM ACCURACY

AND HOW TO GET IT



PRECISE dimensions and clean, sharp cross-sections don't "just happen" in plastics extrusions. They are solely the result of advanced design in the extruder. For example:

The barrel—Different working characteristics of the various plastic materials make provision for *zone-heating* a must, if uniformly accurate plasticizing is to be obtained.

Heating medium—Each heating medium—oil, electric, electric-steam—has its own special advantages. Uniform accuracy of product demands application of the proper temperature at the proper points.

The head—Temperature must be accurately controlled in the extruding head to insure correct plasticity at the exact moment of extrusion.

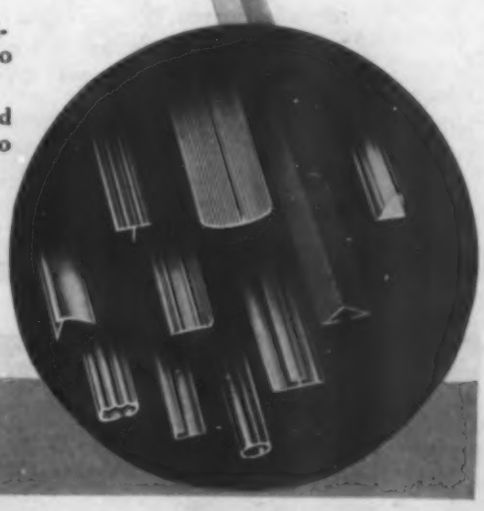
Screw—The pitch, length, root diameter and design of the flight . . . all these are factors of extreme importance to uniform accuracy.

Speed—For production of uniform, accurate extrusions, operating speeds must be capable of close control.

Feed—A most important factor in uniform accuracy is feed. If feed varies, so does the product.

Conveyor—Precise control of speed and position of the take-off is essential to precision extrusion.

These are the elements which, properly balanced against each other, result in high-volume, close-tolerance production. To bring them into balance by actual trial production runs is the function of our Plastics Pilot Plant. Its facilities and personnel are at your service.



CLIFTON DIVISION

Plastics Division

NATIONAL RUBBER MACHINERY COMPANY

General Offices: Akron, Ohio



.50 CALIBER BABIES

Spit Bullets from Lightweight

INSUROK CRADLES

Up there in the fore part of those wings, nestled snugly in gun troughs of FORMED INSUROK, are batteries of .50 caliber machine guns—tough babies that pack a wallop—that are rough on anything that gets near them.

Tough, too, are the troughs of INSUROK T-700. High impact strength lets them take the beatings and be ready for more. Yet, even more important is the weight reduction made possible by this versatile material. It saves priceless pounds wherever it is used.

INSUROK T-700—a thermosetting, fabric type sheet material is also resistant to corrosion and most chemical action. It has low heat conductivity and does not support fungus growth.

Under proper processing, it permits simple and some compound bending and has limited drawing characteristics.

The forming can be done without requiring complicated, costly dies. Size and shape variations and specification revisions can be easily met. It is therefore particularly well adapted to both large and small run, war-product applications.

Richardson Plasticians will be glad to assist in the application of any of the many grades of Laminated or Molded INSUROK for present or contemplated products. Write for complete information.

INSUROK

Precision Plastics

The RICHARDSON COMPANY

MELROSE PARK, ILL. NEW BRUNSWICK, N. J. FOUNDED 1858 INDIANAPOLIS 1, IND. LOCKLAND, CINCINNATI 15, OHIO
DETROIT OFFICE 4-252 G. M. BUILDING, DETROIT 2, MICHIGAN NEW YORK OFFICE 75 WEST STREET, NEW YORK 6, N. Y.

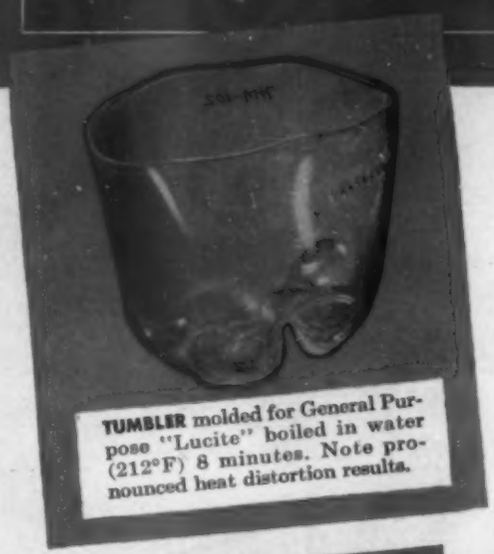
NEW!

Heat-Resistant "LUCITE"

methyl methacrylate resin

MOLDING POWDER





TUMBLER molded for General Purpose "Lucite" boiled in water (212°F) 8 minutes. Note pronounced heat distortion results.



THIS TUMBLER, molded from *heat-resistant* "Lucite," was boiled in water (212°F) for 8 minutes in a comparative test. Note its superior heat resistance—how it withstood this test with only slight change in shape and clarity!

A Du Pont Wartime Development For All-Time Use

Articles molded from new "Lucite" formula show a marked superiority in *heat resistance* over those molded from General Purpose "Lucite" or other acrylic powders.

HEAT-RESISTANT "Lucite" has been developed by Du Pont to meet the wartime need for a molded methyl methacrylate thermoplastic with increased heat stability, necessary in many different instances where a material of lower yield temperature cannot be used. This material yields molded articles remarkably resistant to heat, but its use is not recommended for articles which are to be subjected to boiling water or to temperatures in excess of 200°F.

HEAT-RESISTANT "Lucite" is not intended to replace the General Purpose "Lucite" molding powders, which have given such outstanding service in the past in cases where high heat-resistance in the molded article is not essential.

See at left unretouched photographs of drinking tumblers molded from General Purpose "Lucite" and from *heat-resistant* "Lucite" molding powders. Here is visual evidence of the marked superiority in heat-resistance of the new "Lucite" over General Purpose "Lucite" or other acrylic powders. (These tumblers do not represent a current wartime application of *heat-resistant* "Lucite," but are used for illustrative purposes only.)

APPLICATIONS—*Heat-resistant* "Lucite" offers many possibilities for new and improved design. Here are some typical product-uses for *heat-resistant* "Lucite": flying and airport light lenses . . . reflectors and lenses for military vehicles . . . cases for lamps and batteries . . . dial and meter faces . . . medical and dental instruments . . . electrical switchboard color caps . . . railroad signal light lenses . . . coverings for industrial lights . . . bathroom fixtures for barracks and battleships . . . and scores of other applications.

BACK THE ATTACK WITH WAR BONDS

FREE BOOKLET *on Heat-Resistant "Lucite"*—Contains valuable information for molders, designers, engineers and production men. Compares the properties of *heat-resistant* "Lucite" with those of General Purpose "Lucite." For your *free* copy, or for information on the best use of Du Pont plastics, write to: E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, New Jersey . . . or, 5801 So. Broadway, Los Angeles 3, California.

DU PONT

"LUCITE"

methyl methacrylate resin

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Leadership . . .



To retain its leadership among plastic injection molding machine manufacturers, Reed-Prentice Corporation observes one primary rule—Study the Business. No suggestion received from our customers is too trivial for engineering consideration. Hundreds of such suggestions have influenced Reed-Prentice design, with the result that Reed-Prentice 10D machines are best adapted to the practical needs of plastic injection molders.

BRANCH OFFICES
1213 W. 3rd. St.
Cleveland. Ohio
75 West St.
New York City. N. Y.

REED-PRENTICE CORP.

MAIN OFFICE
WORCESTER
MASS. U. S. A.

The yanks are coming!



These Lumarith door handles emerge from the mold smooth and perfectly formed—ready for the tugs of truck drivers who are also Marines, and for the punishment of combat climates. Qualities of toughness—resistance to corrosion, chipping, warping—these handles have them all. ★ ★ Lumarith with its high impact strength and clear-through color is showing the way to a new conception of the function of plastics in manufacture. New production techniques are keeping pace with the spreading popularity of plastics, solving difficult molding problems of double cores, close thread tolerances, and interchangeability of parts. ★ ★ To assist the manufacturer, the custom molder, and designer the Celanese Celluloid Corporation maintains a technical service division which is prepared to advise on your molding problems in reference to formulation, heat, dies, pressure, flow, etc. Information on the various molding methods: injection, extrusion, compression, and transfer is instantly available.

CELANESE CELLULOID CORPORATION, a division of Celanese Corporation of America, 180 Madison Avenue, New York City. ***Representatives:*** **Cleveland, Dayton, Philadelphia, Chicago, St. Louis, Detroit, Los Angeles, Washington, D. C., Leominster, Montreal, Toronto, Ottawa.**

WAR MESSAGE

A patriotic appeal should not be necessary to sell Government Bonds and Stamps to sensible Americans. Putting money aside to buy things later, is like putting tomorrow's food away in the refrigerator—only much better. Bonds don't spoil! Bonds don't shrink. In fact, they get bigger, so you can buy 4 lbs. of anything later on, for the price of 3 lbs. now. . . . And more important, you speed Victory!

LUMARITH®

A Celanese® Plastic

*Trade Marks Reg. U. S. Pat. Off.

TIME TO CROW

...when we're in Tokio!

Feeling cocky about the war?
Better not . . . you can't crow
without sticking your neck out!

• • •

Sure, there have been . . . and there will be . . . successes along the road to Victory. But these must not make any of us over-confident.

Rome. Even Berlin! Just milestones on the long, hard road to Tokio. With a fanatical foe contesting every inch of the way!

Only a tidal wave of men, materiel and money will engulf Japan!

To help swell this wave, American industry must have . . . at once: WOMEN . . . by the many thousands to take the places of men gone to war.

Even more important . . . EFFORT to the point of sacrifice on the part of every man and woman in industry . . . workers and bosses.

Another must . . . DOLLARS! . . . And the coming Victory Loan is a further opportunity to show our enemies what their fate shall be.

• • •

Crow? Sure! But only in Tokio!



Carrier
Syracuse, N. Y.

Makers of Air Conditioning and Refrigeration Equipment

• *This message in poster form for use on factory bulletin boards is available upon request.*

Investigate...

-MEGATHERM-

The New All-in-One Unit that Provides
ELECTROSTATIC HEAT for the PLASTICS INDUSTRY



Heats the Preform by Radio Frequency

Permits Perfect Molding at Low Pressures

Prevents Breakage of Die Inserts

Reduces Curing Time from Minutes to Seconds

Assures Uniformity, Speed and Economy

Design Highlights:

★ Automatic Safety Interlocks and Overload Protection

★ Electrically Designed to Prevent Radio Interference

★ Two Power Tubes: Federal Type F-128-A

★ Six Rectifier Tubes: Federal Type F-872-A

★ Heavy Duty, Industrial-Type Cabinet

It is the unique ability of Radio Frequency Electrostatic Energy to heat each molecule of material rapidly and uniformly regardless of its location in the preform. This means that particles in the center of the mass as well as those at the surface are heated simultaneously and to the same degree.

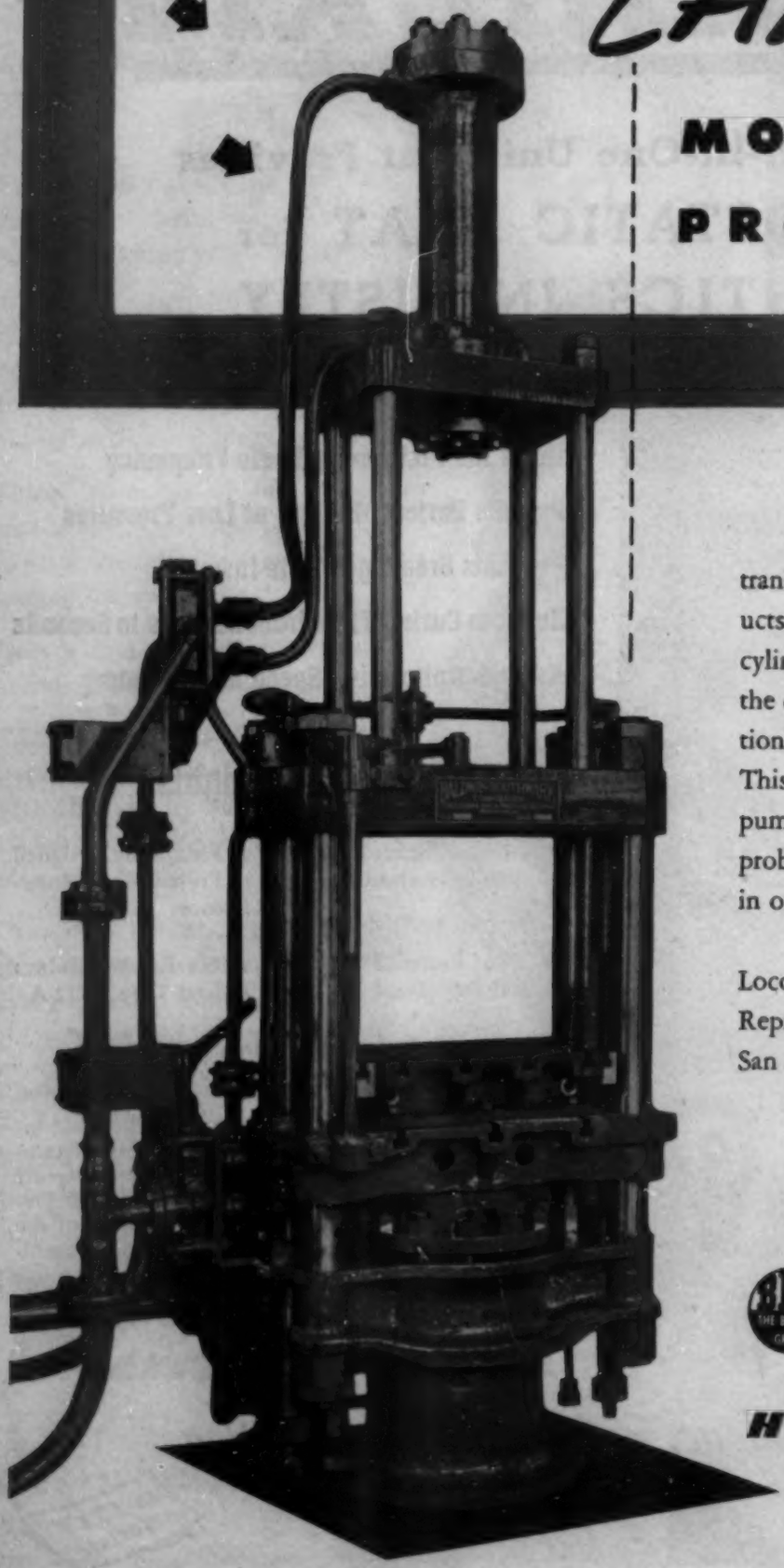
We invite you to discuss your problems with us.

Federal Telephone and Radio Corporation

INDUSTRIAL ELECTRONICS PRODUCT DIVISION, Newark, New Jersey

AN IT&T ASSOCIATE

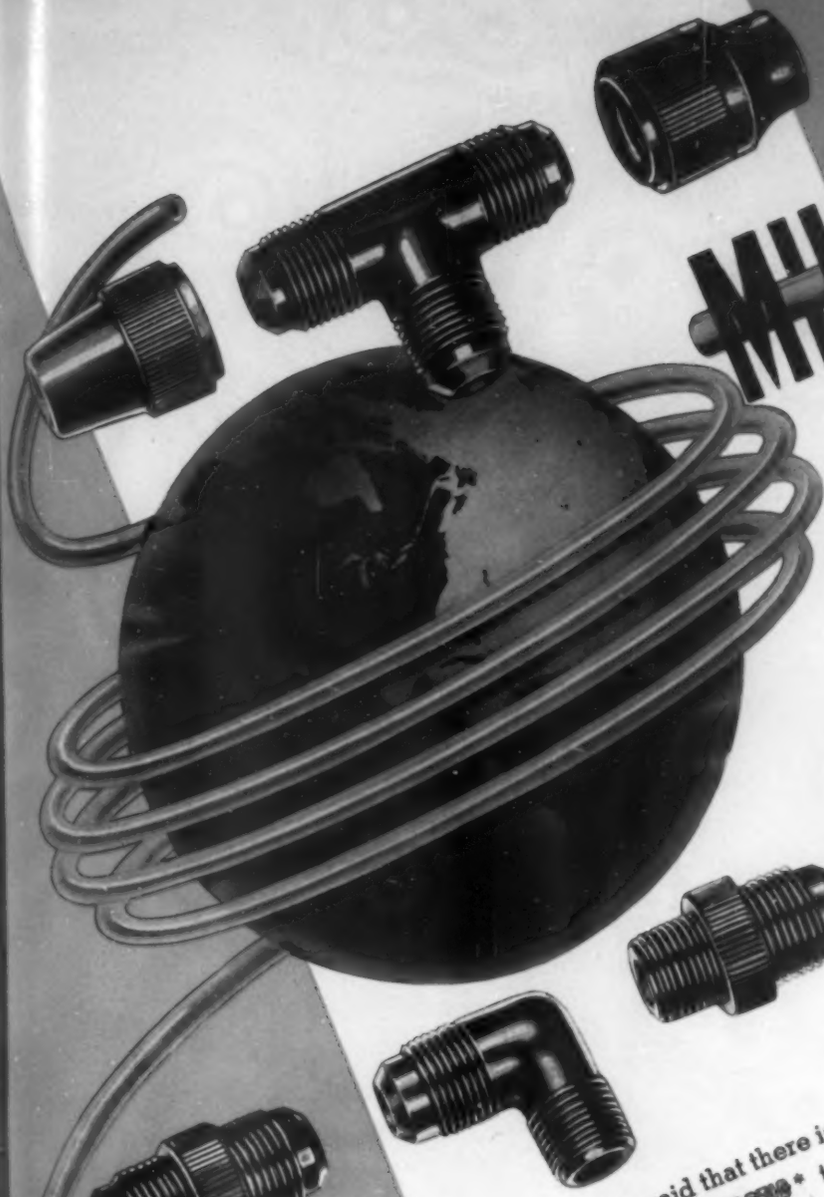
FOR LARGE MOULDED PRODUCTS



Here Southwark presents a semi-automatic transfer moulding press for large moulded products of Thermo-setting materials. The lower cylinder gives ample clamping pressure to keep the dies closed thereby resisting the high injection pressure created by the upper cylinder. This press is also available with a self-contained pumping unit. Usual or unusual equipment problems are all the same to Southwark. Call in our specialists.

Baldwin Southwark Division, The Baldwin Locomotive Works, Philadelphia; Pacific Coast Representative, The Pelton Water Wheel Co., San Francisco.

BALDWIN
SOUTHWARK
HYDRAULIC PRESSES



MILLS PLASTIC

TUBING AND FITTINGS

World-Wide in Field of Applications

It has been said that there is nothing new under the sun, but MILLS-PLASTIC* tubing and fittings have proven to be something not only new, but sensational, in their adaptability under high bursting and working pressures, insulating qualities, flexibility, ease of handling and resistance to most chemicals. MILLS-PLASTIC tubing and fittings—and pipe, too—have replaced vital materials needed in the war effort, such as aluminum, brass, copper, nickel and stainless steel . . . after the duration, MILLS-PLASTIC will continue to replace these competitive materials in a variety of applications.

MILLS-PLASTIC tubing is available in outside diameters of 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8" and 3/4" in a variety of wall thicknesses. Special sizes upon request.

*Made of Saran

For more information about MILLS-PLASTIC tubing and fittings, write for the new circular or for our new catalog containing data and illustrations of Injection Molded and Extruded Plastics.



Elmer E. Mills Corporation

Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Crystallite Polystyrene, Styron, Lustron, Loslin, Vinylite, Mills-Plastic, Saran and Other Thermoplastic Materials

812 WEST VAN BUREN ST. • CHICAGO 7, ILLINOIS

Moving to Larger Quarters —after October 15, our address will be 153 W. Huron Street, Chicago 10, Illinois.



A BEAUTY WINNER ATLANTIC CITY DIDN'T SEE

There's one all-American beauty that didn't have to go to Atlantic City to win a title.

And that's KYS-ITE.

This new miracle plastic gets a chorus of "oh's" and "ah's" wherever it is seen for it comes in a wide range of colors that vie with Nature. Best of all, its beauty is more than skin-deep, too. The color goes all the way through.

What's more, time can't mar KYS-ITE's beauty.

Even boiling it for days in salts, soaps and mild acids fails to warp or disfigure it. Alcohol, grease and mild alkalies can't stain its lovely surface.

KYS-ITE is made of long pulp fibre and synthetic resin which is preformed to shape before curing. It has four to five times the impact strength of ordinary plastics—yet weighs but half as much as aluminum.

Even though certain restrictions made KYS-ITE unavailable for anything but war purposes, you'll probably want to know more about this amazing material that can be used for structural parts, and almost anything that can be molded.

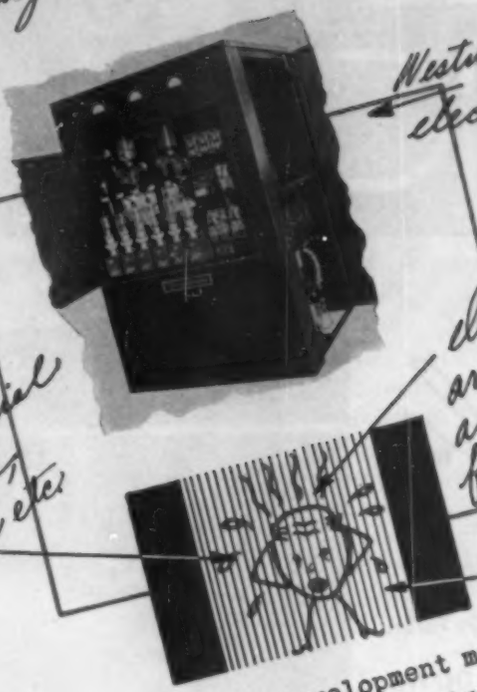
Just drop us a note. We'll be glad to give you the facts.

KEYES FIBRE COMPANY, WATERVILLE, MAINE

• LET KYS-ITE MOLD YOUR FUTURE •

MEMO TO J. Smith chief engineer

RE: Heating non-metallic materials with "Cold heat"



Jim: This Westinghouse development may be the answer to our heat-curing problems. Imagine putting stuff like plywood between two plates, and heating it uniformly to 300 deg. F. in 3 minutes, with radio waves!

This thermo-electronic heating equipment generates heat uniformly throughout the material—like the "artificial fever" you read about. Best of all, there's no overheating of the outside surface and underheating in the center.

This cuts heating time as much as 95%, they claim, because you don't wait for heat to penetrate to the center—it's already there! This speeds up chemical reactions, too.

As I understand it, Jim, there are some limitations. Some materials with low "heat loss factor" like hard rubber just won't heat as fast as others. Size of surface and degree of dryness required from wet materials are other limiting factors. But aside from these, I think we should check into this. Why don't you give this thing a look?

Joe

J-08055



For information on Westinghouse High-Frequency Dielectric equipment, write Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. J-44.

Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Electronic Heating

Molded PLASTICS BY Reynolds







SPECIALISTS in plastic molding for over 22 years Reynolds is now using the versatile knowledge of its experienced organization 100% on war work. Its compression, injection and extrusion presses are turning out vital plastic parts. Its sheet forming department is delivering transparent, lightweight, turret canopies, that enable fighting planes to fly faster and higher and carry heavier loads of deadly promise for the enemy.

If its plastics, consult Reynolds.

INVEST IN WAR BONDS

REYNOLD'S MOLDED PLASTICS
CAMBRIDGE, OHIO
SALES ENGINEERS IN ALL PRINCIPAL CITIES.
A DIVISION OF REYNOLD'S SPRING COMPANY, JACKSON, MICHIGAN

The Future of MOLDED PLASTICS



This fully-automatic compression molding machine is available in 25, 50 and 75-ton models. Its features are fast operation, centralized control, positive action safety devices and rapid mold changes.

Even while the tempo of stepped-up war production continues unabated, manufacturers are studying their post-war prospects. There is hardly an industry that is not considering the use of plastics for many commercial uses never before thought of. Only recently Thurman Arnold, former Assistant U. S. Attorney General, stated: "We are only on the threshold of the plastics industry . . . the present airplane program will increase plastics production a hundredfold . . . indeed, we may be on the verge of a new industrial era—the light metal and plastics age."

Watson-Stillman, anticipating this post-war development, has installed a modern, well-equipped laboratory in the Roselle, N. J. plant. Here, designers and engineers are studying molding machine problems; expert chemists are doing research work to discover new and better plastics formulae. This combination of talents is at the disposal of manufacturers who are farsighted enough to plan NOW for the transition from war to peace-time activities. W-S invites you to consult its engineers on any phase of plastics molding. The Watson-Stillman Company, Roselle, N. J.

WATSON-STILLMAN

Hydraulic Equipment, Valves, Forged Steel Fittings



W-S semi-automatic compression molding machine with push-button control for manual or semi-automatic operation. Made in wide range of sizes.



Injection molding machine, made in 6, 8, 12 and 16-oz. capacities. Equipped with zoning control, heating cylinder and positive clamping mechanism.

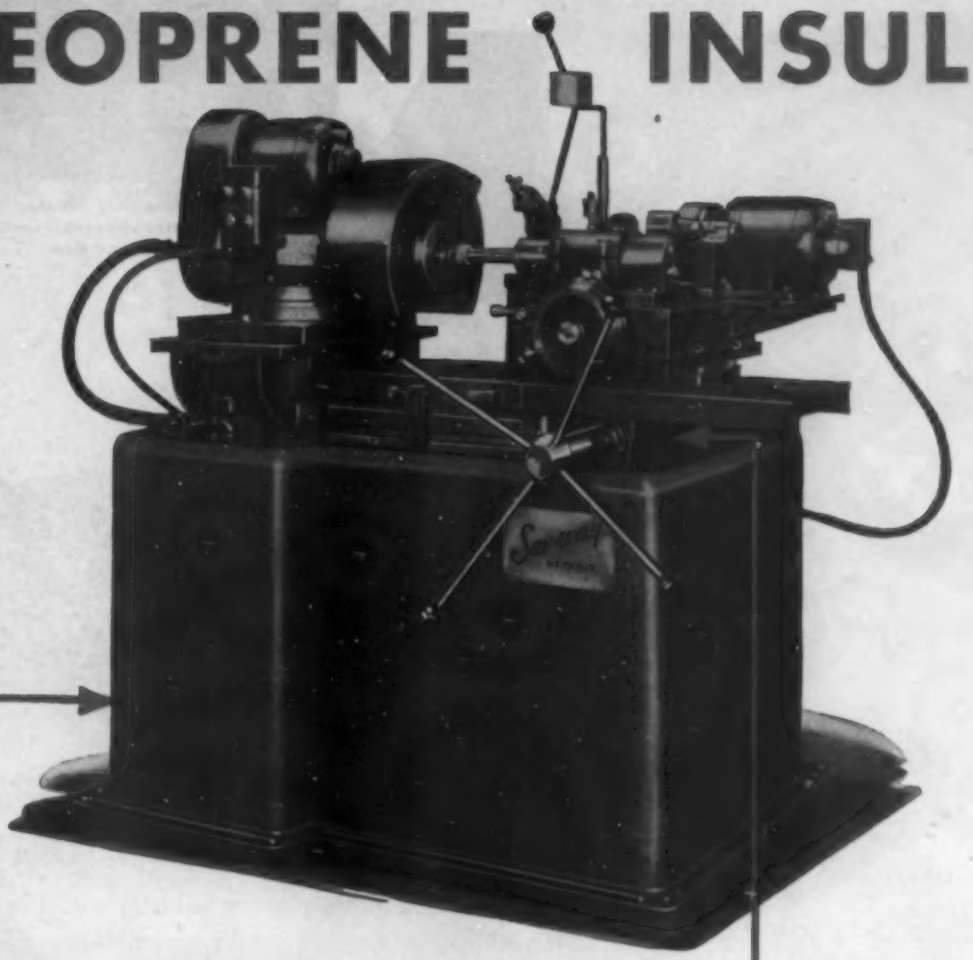


For Victory ★★★ Let's all be Scrappers

For the grinding of plastics molds and for countless other toolroom uses in the plastics manufacturing plant, this Sav-Way internal grinder offers many worthwhile advantages, including ease of set-up, flexibility, and range of adjustment for a variety of work. It is proven by more than two years of successful operation on the most exacting of aircraft and ordnance parts. Send the coupon for complete description and specifications.

Sav-Way's extensive research and experience in the plastics machinery field gives us an understanding of plastics manufacturing problems which will be of value to any plant anticipating the purchase of grinding equipment.

NEOPRENE INSULATED



against Vibration, Distortion, Misalignment!

This radical departure from conventional design gives the Sav-Way multi-purpose internal grinder a new permanence of alignment and resulting higher accuracy. The bed proper is a thick surface-plate type normalized alloy iron casting of heavily ribbed whale-back construction. Neoprene pads between the bed and the steel base eliminate metal-to-metal contact and absorb floor vibration, preventing distortion of the base being transmitted to the bed, which is accurately scraped. This is only one of seventeen specific features which make the new Sav-Way M-1-A Grinder outstanding in design and construction.

For complete description and specifications, attach the coupon to your letterhead.



Send the Coupon for Your Copy

SAV-WAY INDUSTRIES, 4875 E. 8-Mile Road
Detroit, Michigan

Kindly send me a copy of the illustrated folder describing the Sav-Way M-1-A Internal Grinder.

Name_____

Position_____

Firm_____

Address_____

City_____ State_____

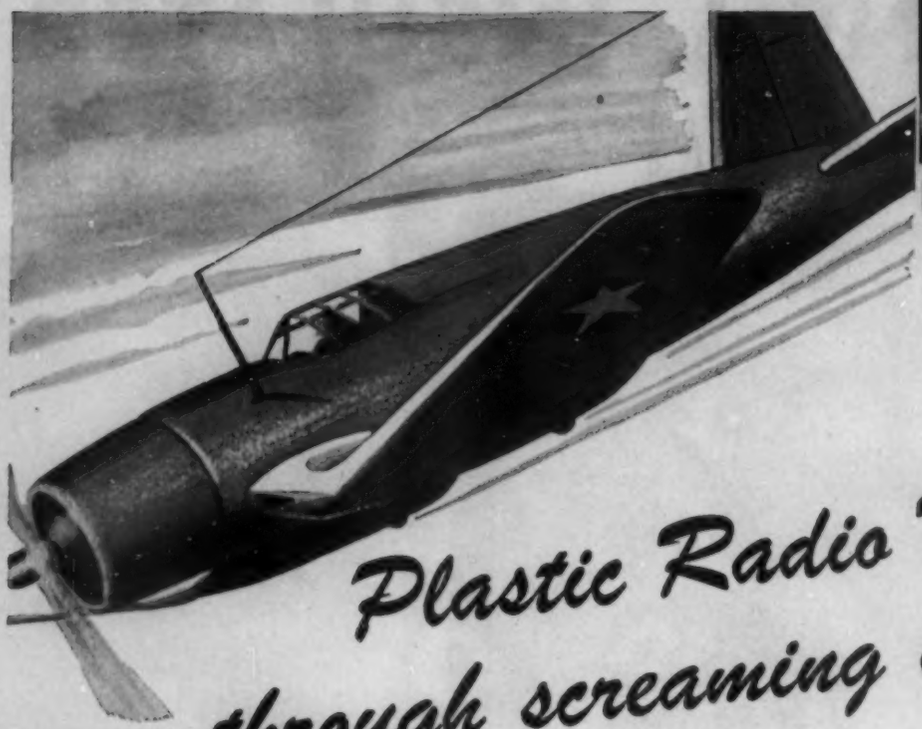
KEEP AN EYE ON

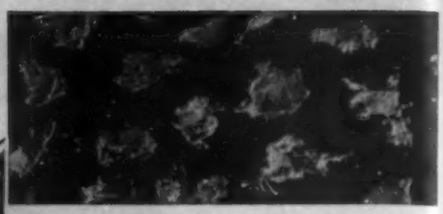
Sav-way INDUSTRIES

* Machine Tool Division *

4875 EAST EIGHT MILE · DETROIT, MICHIGAN

PRODUCERS OF SAV-WAY HAND AND HYDRAULIC INTERNAL GRINDERS • SAV-WAY GOLD SEAL SPINDLES • PLUG GAGES • PRECISION AIRCRAFT AND AUTOMOTIVE PARTS





FABRIFIL Macerated cotton fabric for extra strength; uniformity assures good flow.

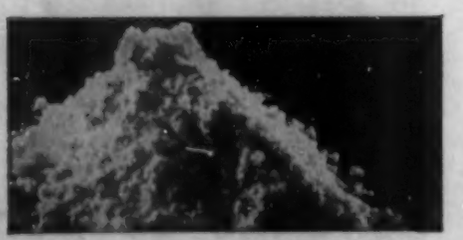
Plastic Radio Masts that come through screaming dives intact



THANKS TO RAYCO FABRIFIL

New scope was brought to the plastics industry with the introduction of cotton fillers, as typified by Rayco products. One of the most interesting developments was the airplane radio antenna mast, in which the tendency to fracture at the base was overcome by the use of a fabric filler. Rayco "Fabrifil," consisting of macerated cotton fabric, imparts exceptional filler strength to plastic products. Rayco "Filfloc" gives a desirable strength increase when used instead of wood flour in compounding. "Cordfil," a widely used Rayco product, consists of specially cut lengths of cotton tire cord, and has an outstanding reputation for excellent flow qualities as well as for imparting a high degree of strength.

Dependable uniformity, cleanliness and purity characterize all Rayco fillers. It PAYS to have them in your powders.



FILFLOC Pure cotton flock of surpassing cleanliness and uniformity.



CORDFIL Evenly cut lengths of tire cord; for plastics of utmost strength.

Insist on compounds containing RAYCO-Fillers—for good flow and maximum strength.

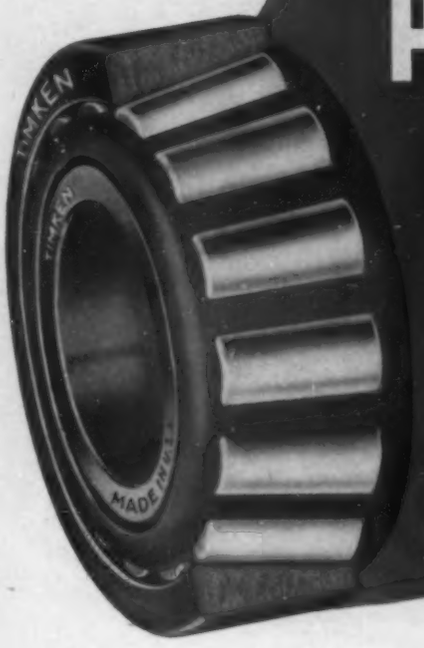
RAYON PROCESSING CO. of R.I. INC.

60 TREMONT ST., CENTRAL FALLS, RHODE ISLAND

Developers and Producers of Cotton Fillers for Plastics

One sure way..

TO IMPROVE THE PERFORMANCE OF *Plastic* EQUIPMENT



Use Timken Tapered Roller Bearings at every suitable point of friction and hard service in mills, mixers, extrusion machines, calenders, pre-forming presses, grinders, lathes, drills, tumblers, abrasive cut-off machines, abrasive forming machines and stamping presses.

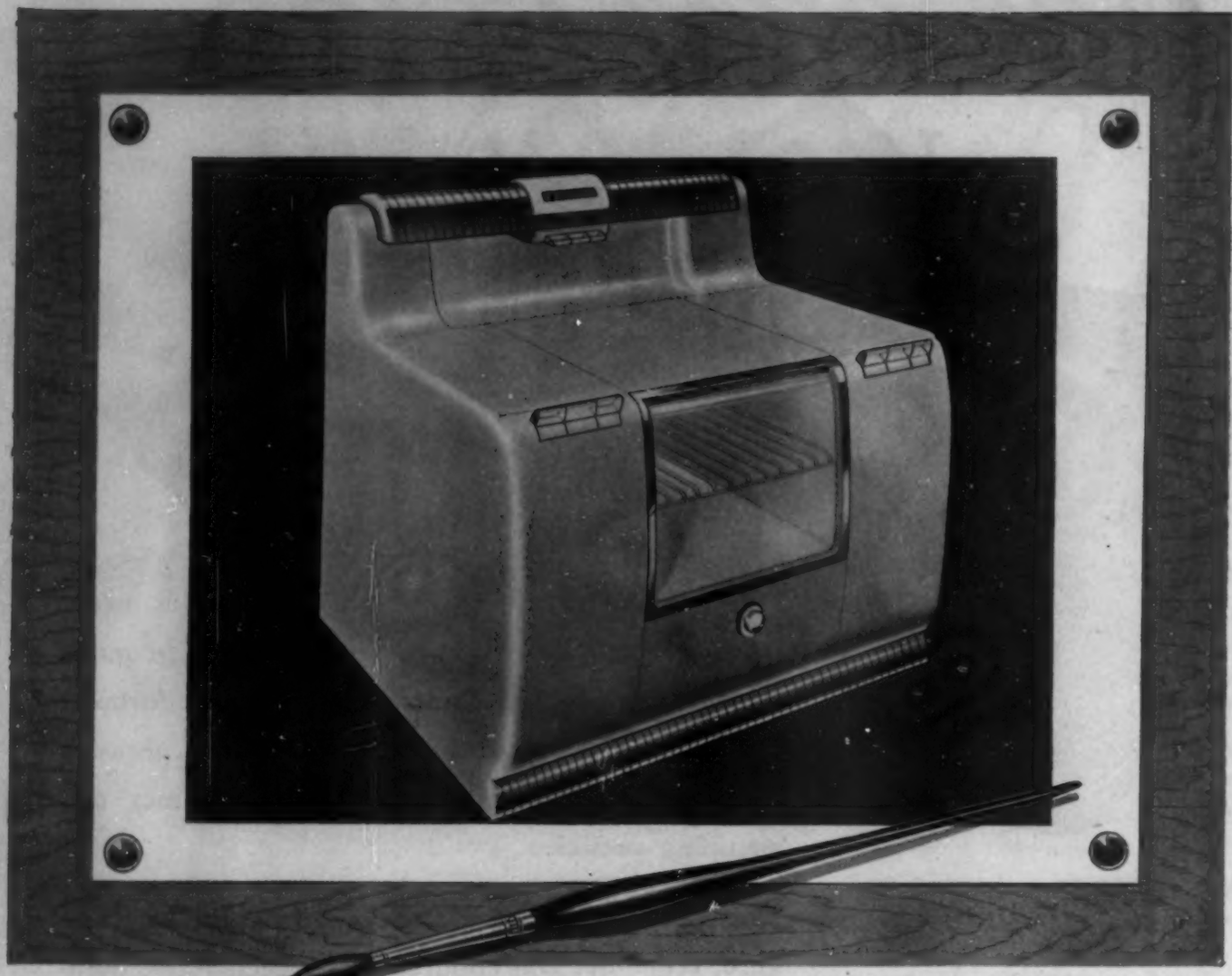
Then you will be assured of first-class performance; economy; and endurance; for then your equipment will be fully protected against friction, wear, radial, thrust and combined loads and misalignment of moving parts.

Furthermore, where precision is an essential factor of performance, there is no surer way to get it—and keep it—than by the use of Timken Bearings. Precision machine tool manufacturers found this out many years ago. The Timken Roller Bearing Company, Canton, Ohio.

Don't wait to see what will happen after Victory. Prepare now for keen competition; redesign your equipment, using more Timken Bearings.

TIMKEN
TAPERED ROLLER BEARINGS

Forecast!



From the drawing boards of Sundberg and Ferar

A RANGE OF BEAUTY

Beauty with a practical side is in store for housewives buying electrical ranges or any home appliance after the war. New plastic techniques and plastic applications together with streamlined design, as shown above, will make possible new joys in post-war living.

In this range of the future, controls are of transparent plastics; one of them serves to open the oven door automatically. The entire contents of the oven will be seen through curving clear material. Plastic fluorescent fixture and plastic case of the timing unit add to attractiveness and utility.

But plastics in ranges and other home appliances are only a few thousands of applications. In offices, stores, industrial plants and even on the farm, plastics will play an important part. Plan now to take advantage of plastics in your product development. Call upon Kurz-Kasch engineers, designers and molders, specialists in plastics planning and production for more than a generation.

BACK THE ATTACK — BUY WAR BONDS

KURZ-KASCH

For over 25 years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1417 South Broadway, Dayton, Ohio

Branch Sales Offices: New York • Chicago • Detroit • Los Angeles • Dallas • St. Louis • Toronto

Canada. Export Offices: 89 Broad Street, New York City



light Flight in Broad Daylight

HAZARDS OF BLIND-FLYING training are now reduced by employing the light-wave control inherent in Cellulose Acetate plastic. Through the green cockpit shield, the instructor has complete visibility. But the student, in red goggles, can see only *inside* the plane. If he tries to look through the windshield, he sees nothing but solid black. The red and green together block out every wave length of light.

THE APPLICATION OF ACETATE plastic to problems of light-control has an interesting experience record. In clear sheeting, it can be made to pass ultra-violet rays (important in tubercular hospitals) or to filter out those rays (as in aircraft cowling to prevent sunburn). It is used in greenhouses to speed growth, in poultry farms to step up egg-laying, in store windows to prevent fading of merchandise. It can be made to polarize light. Its limitless colors have broad functional possibilities.

IF YOU WOULD like to know the names of those who make plastics based on Hercules acetate, write Dept. MP-103, Hercules Powder Company, Wilmington 99, Delaware.

Lumarith for blind-flying shields and goggles made by Celanese-Celluloid Corp.

HERCULES

CELLULOSE ACETATE

★

TOUGH • FLEXIBLE • STABLE
LIGHTWEIGHT • ECONOMICAL • CLEAR

HERCULES POWDER COMPANY • WILMINGTON, DELAWARE
Incorporated

Copyright 1941, Hercules Powder Company 000-00

TRIPLE THREAT... FLY FIGHT BOMB



CONTROL STICK
MACHINE GUN TRIGGER
BOMB RELEASE

ERIE RESISTOR PLASTICS

PLANE for plane, American engineering ingenuity has placed superior fighting equipment at the disposal of the United Nations.

Take for example, certain types of fighter craft that are real triple threats for fighting, bombing and out-maneuvering the enemy.

Control center for firing the machine guns, releasing the bombs, and maneuvering many of these planes, is centered in a compact all-plastic control stick grip, injection molded of plastics by Erie Resistor.

Erie Resistor has successfully combined the necessary ruggedness to withstand the mechanical stresses, and the fine precision with respect to dimensions for housing the electrical switches.

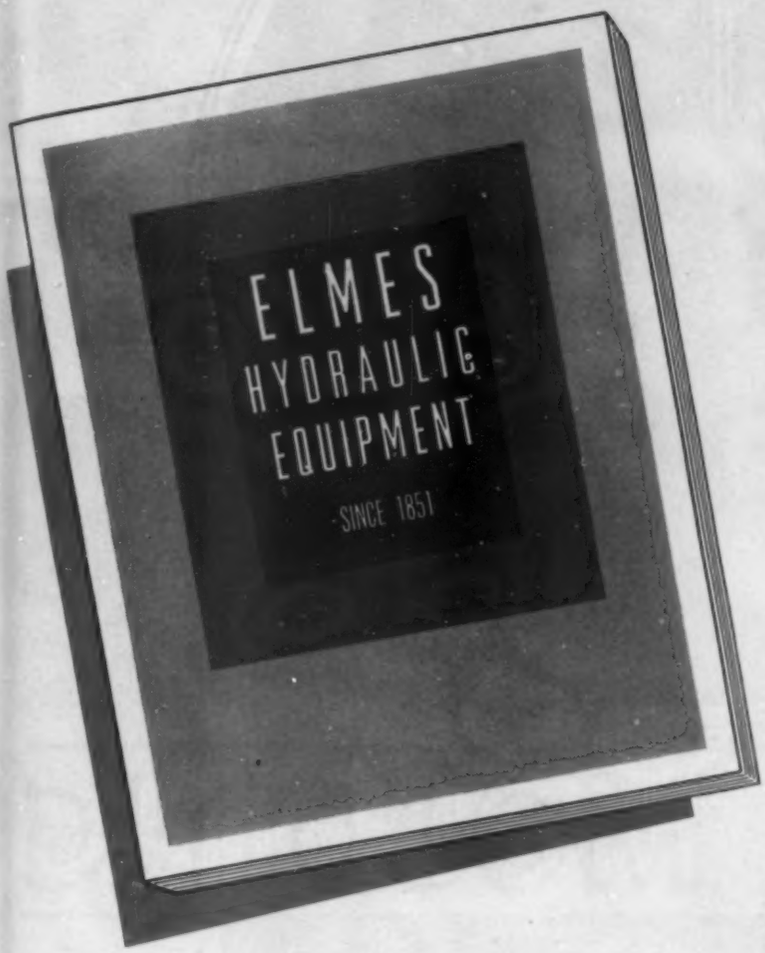
You may not be in the market for control stick grips, but Erie Resistor ingenuity and experience in producing difficult moldings to extremely close specifications is probably the answer to correctly molding your wartime and postwar products. Write for illustrated bulletin describing Erie Resistor's plastic molding facilities.

BACK THE ATTACK—BUY WAR BONDS

ER *Plastics Division* ER

ERIE RESISTOR CORPORATION, ERIE, PA.

Send for this CATALOG *and the New* ELMES PLASTICS BULLETIN



*E*very plastics manufacturer should have this catalog of Elmes Hydraulic Equipment—and the new, highly informative Elmes Plastics Bulletin. The catalog illustrates the various types of Elmes equipment being used with outstanding success throughout the plastics industry. It shows the modern Elmes Compression Molding Presses, Laboratory Presses, Hobbing Presses, Hydraulic Valves, Accumulators and High Pressure Pumps.

INCLUDES SIMPLE ENGINEERING DATA FORM

Every catalog includes a simplified, yet comprehensive form for requesting engineering data on any contemplated application of hydraulic power.

The new Elmes Plastics Bulletin comments authoritatively on matters involving plastics production as related to the use of hydraulic equipment. Other such bulletins will be released from time to time.

HIGHEST DEVELOPMENT OF HYDRAULIC EQUIPMENT

Elmes' reputation for attaining the highest development of hydraulic equipment springs from a background of progressive engineering achievement covering nearly a century. Many of the first hydraulic installations used on this continent were designed and built by Elmes. Plastics manufacturers, faced with many production problems, are finding their solutions in the broad experience, the inventive skill and sound methods of our engineers.

Whether your needs are for standard or specialized hydraulic equipment—for plastics or general manufacture—Elmes should be your first thought for cost estimates or engineering collaboration. Mail the coupon for the Elmes Catalog and Plastics Bulletin. ELMES ENGINEERING WORKS of AMERICAN STEEL FOUNDRIES, Chicago.

ELMES HYDRAULIC EQUIPMENT

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • PUMPS
EXTRUSION PRESSES • ACCUMULATORS • VALVES • ACCESSORIES

Also Manufactured in Canada

Mail it Today!

ELMES ENGINEERING WORKS of
AMERICAN STEEL FOUNDRIES
225 N. Morgan St., Chicago

Please send me the Catalog of Elmes Hydraulic Equipment and the New Elmes Plastics Bulletin. I am interested in equipment for ☐ Plastics ☐ General Equipment.

Name.....

Firm.....

Position.....

Address.....



PLASTIC MOLDING

that meets exacting requirements

Our combination of experienced personnel and the most modern equipment gives you the finest service in injection molding — meets your exacting requirements promptly, efficiently, accurately — from a fraction of an ounce through 18 ounces per shot.

Our presses, along with a complete complementary equipment, include one of the four 18-36 ounce capacity presses available for custom molding. We installed a press of this capacity to answer demands for complete dash panels, garnished moldings, and similar trim.

ARMY E 1st NAVY

The METAL SPECIALTY Co. PLASTIC DIVISION

MAIN OFFICE AND PLANT • ESTE AVENUE • CINCINNATI, OHIO

IMPACT STRENGTH OF

Plexiglas

PROVED BY MEASURED BLOWS



The Charpy Impact test is used to determine the impact strength of PLEXIGLAS *under all conditions.* PLEXIGLAS *shows no loss of impact strength even at -65°F.*

IMPACT strength, tensile, compressive, flexural, and shear strength, hardness and cold flow are a few of the important PLEXIGLAS properties described in detail in the new PLEXIGLAS *Mechanical Properties* Manual. Published by Rohm & Haas to help speed the use of PLEXIGLAS in war production, this new handbook contains graphs and photographs never published before.

Write our Philadelphia office for your copy.

★ ★ ★

Rohm & Haas Company, Washington Square, Philadelphia, Pa. *Other offices in:* South Gate, Los Angeles—Detroit—Chicago. *Canadian Distributor* — Hobbs-Glass Ltd., Montreal, Canada.

THE CRYSTAL-CLEAR ACRYLIC PLASTICS

PLEXIGLAS

SHEETS AND RODS

★

CRYSTALITE

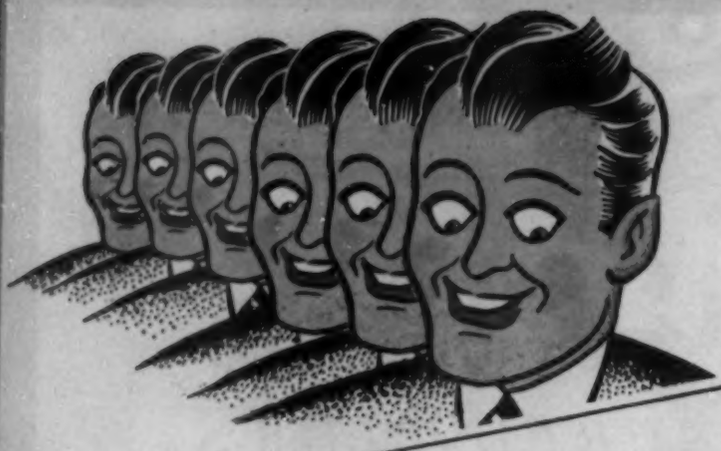
MOLDING POWDER

PLEXIGLAS *and* CRYSTALITE *are the trade-marks, Reg. U. S. Pat. Off., for the acrylic resin thermoplastics manufactured by the Rohm & Haas Company.*

ROHM & HAAS COMPANY

WASHINGTON SQUARE, PHILADELPHIA, PA.

Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile and other Industries



NORTON LABORATORIES (INCORPORATED)

CUSTOM MOULDERS OF SYNTHETIC PLASTICS
BAKELITE DUREZ

LOCKPORT, N.Y.

NORLOC NOVELTIES

ALL AGREEMENTS ARE CONTINGENT UPON STRIKES, FIRES, ACCIDENTS OR CAUSES BEYOND OUR CONTROL. CONTRACTS WITH AGENTS NOT VALID UNTIL APPROVED BY AN OFFICER

October, 1943

Customers, prospects and friends--lend me your eyes--

As usual, I want to talk about our business. That's what we buy this space for. It seems I don't have enough time to write letters or make visits on all the people I'd like to keep in touch with, so this seems to be the best way.

I know they all read Modern Plastics (that's what the salesman told us, anyhow, and we're willing to try anything once) so maybe they'll read this piece about us.

This one's about jigs. Not Irish jigs, although we like to dance as well as the next one. No, these jigs are gadgets that fit around things, or next to things and they help you to do your work faster and better.

We like jigs a lot in our plant. We've got some awfully funny ones (some of the molds and the moldings are even funnier, but we understand we're not supposed to describe them to the Axis, but just let them find out the hard way what they're for). One thing about the jigs, they do work. They help us do our work better. They help us do our customers' work better. Perhaps, we might work out a few jigs for you?

We'll write again.....

Sincerely,

M. L. Seekins

M. L. SEEKINS
Factory Manager

PADDED IN THE PROPER PLACES



There's no question about it...a little padding here and there is very important—and most effective!

Particularly is this true in preparing steel molds for hard chromium plating. When proper allowances are made in the die structure, varied thicknesses of chromium can be deposited in accordance with the individual characteristics of the parts themselves and the purposes for which they are used. By padding up the plating in sections subject to greatest wear and by stopping-off other areas, we can engineer longer life into the performance of the finished die.

The desirability of padding and Industrial Hard Chromium's technique of its application are more than meets the eye! We would like very much, therefor, to have the opportunity of discussing its many advantages with your own technical staff. Address your inquiry to

INDUSTRIAL HARD CHROMIUM CO.

"Armorplate for Industry"

15 ROME STREET • NEWARK 5, NEW JERSEY

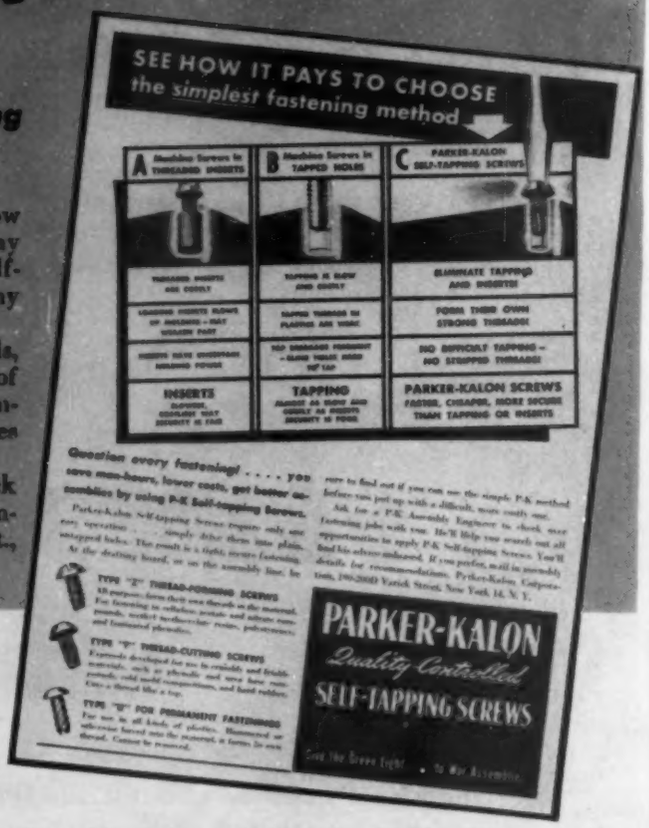
Do You MAKE ASSEMBLIES LIKE THESE THE HARD WAY?

Change over to the simpler P-K Self-tapping Screw method, and you will set new records for Speed!

Your efforts to step up production are sure to show quicker and better results if you will first clear the way by simplifying your assemblies with Parker-Kalon Self-tapping Screws . . . the quickest means of making many fastenings.

Question every fastening job on your drafting boards, and on your production lines, *now*. Like the makers of the three products illustrated, you'll probably find numerous places to save work-hours and get better assemblies with P-K Self-tapping Screws.

Ask for a P-K Assembly Engineer to help you check your fastening jobs. Or, mail assembly details for recommendations. Parker-Kalon Corp., 190-200 D, Varick St., New York 14, N. Y.





SOLVED DESIGN AND PRODUCTION PROBLEM RIVETS WERE IMPRACTICAL . . . TAPPING COSTLY

In developing this volume control the engineers met with difficulties in fastening a Bakelite ring into a thin Bakelite Molded housing. Rivets proved impractical because they cracked the ring. Machine screws were unsatisfactory because it was difficult and costly to tap such small holes. P-K Type "Z" Screws, turned into plain molded holes, gave a perfect result with unmatched simplicity.



SAVE 2 TO 3 MINUTES TAPPING-TIME PER PART

"Without P-K Self-tapping Screws, the design of this Aero-snap Midget Switch would be impracticable," says the Aero Electric Co. of Cleveland. Use of P-K Type "F" Screws to fasten the metal contact to the plastic base also saves the two to three minutes that tapping would require. The Type "F" Screw *cuts* a machine screw thread as it is turned in. The fastenings have the security that is needed for this switch, which is used in large numbers on tanks, aircraft, and other important war equipment.



DESIGN AND PRODUCTION COMPLICATIONS AVOIDED IN THIS PLASTIC PRODUCT

Standard Register Company used Type "Z" Screws as trunions for a door, eliminating a hinge. Type "F" Screws hold metal unit in plastic case; also fasten spring steel catch. Type "U" Screws fasten a hinge to the case. Tapping, metal inserts, lock washers are avoided. Fastenings are more secure than if made by other methods.

PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

HAVE A LOOK THROUGH OUR FUTURE-OPTICON



WE DON'T know anything about postwar planning—we've always operated on an individual basis of taking care of our customers, and thereby taking care of ourselves.

We have got some ideas about postwar plastics, however. We think they'll be cheaper—increased raw materials sources, improved manufacturing methods, increased acceptance of plastics—all add up to lower costs.

We think they'll be better. Plastic materials have been improved consistently ever since they were first discovered. This process has been accelerated, if anything, by the war. It should certainly carry over into the competitive peace times that will come.

We expect to be very much in the plastics business after the war. We'll be doing business in the same way—with improvements: an honest profit, openly arrived at, good moldings (not perfect), and an earnest desire to work with customers.

Try us then.

"A Ready Reference for Plastics" written for the layman, is now in a new edition. If you are a user or a potential user of molded plastics, write us on your letterhead for a copy of this plain non-technical explanation of their uses and characteristics. Free to business firms and government services.



BMCO

ARMY E NAVY

BOONTON MOLDING COMPANY

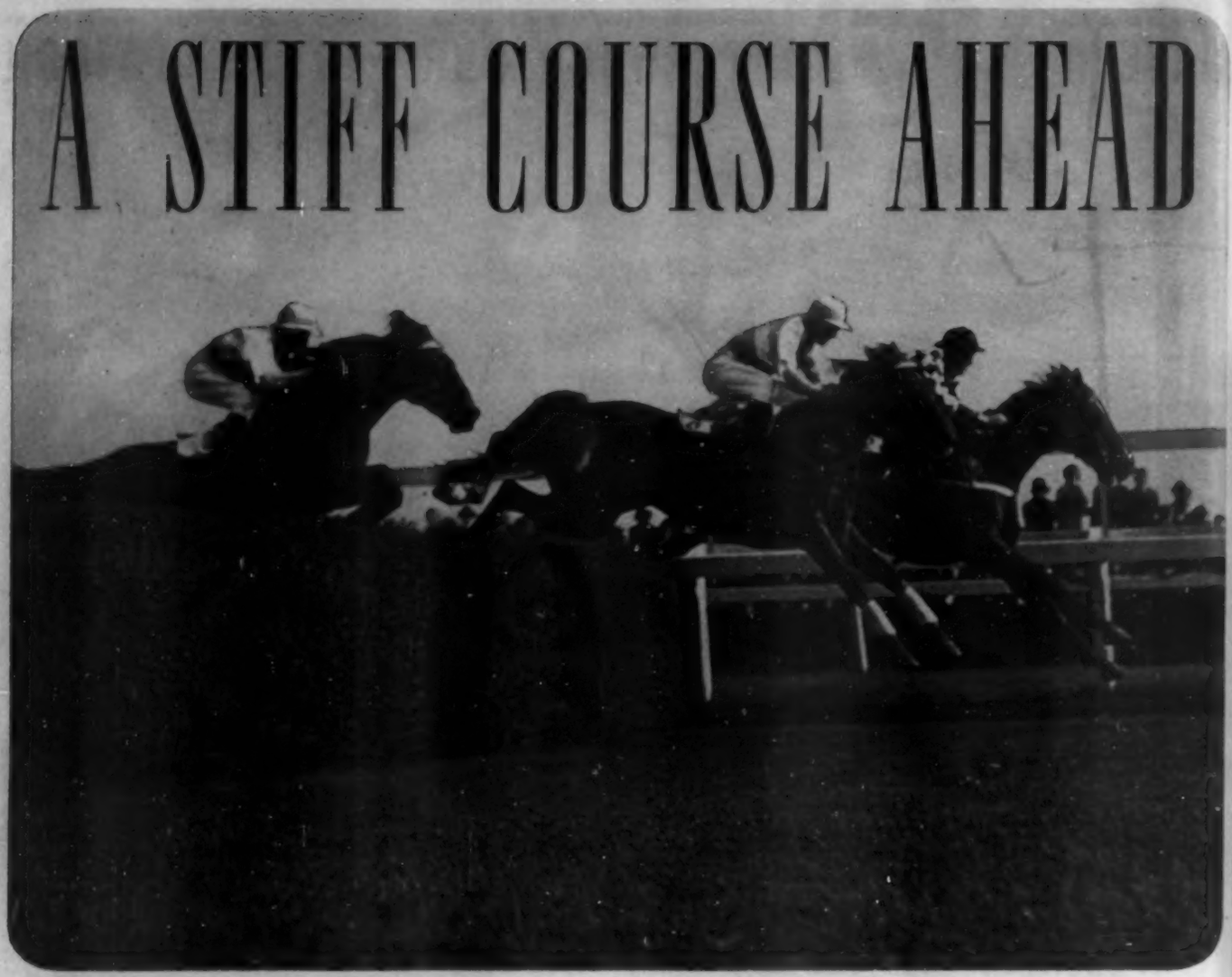
MOLDERS OF PLASTICS · PHENOLICS · UREAS · THERMO PLASTICS

BOONTON · NEW JERSEY · Tel. Boonton 8-2020

NEW YORK OFFICE

Chanin Bldg., 122 East 42nd Street, New York 17, N. Y., MUrray Hill 6-8540

A STIFF COURSE AHEAD



Win the Post-War Competitive Race with a Product Molded by Sinko

PRODUCTS being readied now for the post-war trade indicate tough competitive conditions ahead. Old, pre-war products are going to present an out-dated appearance under the flood-lights of the streamlined, post-war store. They'll be dust-gatherers on the back shelves, shouldered aside by merchandise designed for modern eyes, modern tastes and modern tempo.

Don't wait. Prepare now to hit the market between the eyes with a product that fits the future! And let SINKO work with you. Smooth, warm, colorful SINKO Precision Injection Moldings form exquisite yet practical parts and products. Altho buried deep in war production today, we're ready to give far-ahead planners valuable aid on products for the future. Will you submit your problems now?

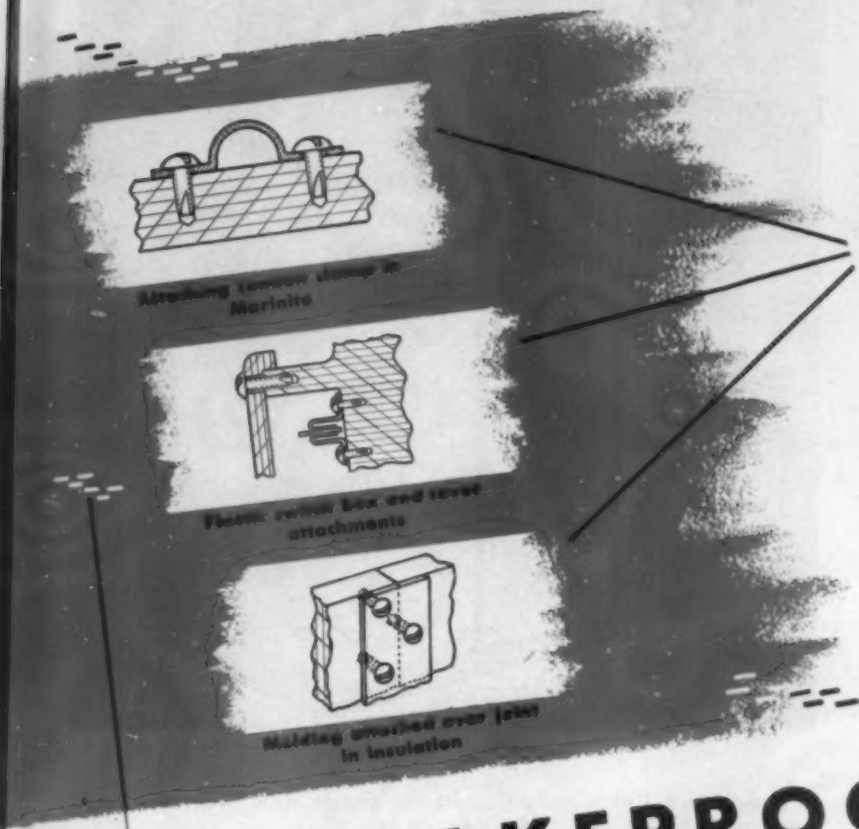
Sinko

PRECISION INJECTION MOLDING

SINKO TOOL & MANUFACTURING COMPANY, 351 NO. CRAWFORD AVENUE, CHICAGO, ILLINOIS

REPRESENTATIVES: L. D. MOORE, 4030 CHOUTEAU AVE., ST. LOUIS, MO. • POTTER & DUGAN, INC., 39 WILKESON ST., BUFFALO, N.Y. • ARCH MASON, 259 CENTRAL AVE., ROCHESTER, N.Y. H. O. ANDERSON, 202 HERALD BLDG., SYRACUSE, N.Y. • PAUL SEILER, 7779 CORTLAND AVE., DETROIT, MICH. • QUESSER BROS., 108 EAST NINTH ST., INDIANAPOLIS, IND.

USE A *MODERN* FASTENER FOR *PLASTICS*





End View showing sharp cutting edge

SHAKEPROOF TYPE 25 THREAD-CUTTING SCREWS

Actually cutting its own thread as it is driven, this special screw for plastics eliminates tapping... makes threaded inserts unnecessary... and provides an excellent snug, tight fastening.

An extra wide slot at the base of the Shakeproof Type 25 Thread-Cutting Screw, presents a sharp serrated cutting edge to the work and a large chip cavity which prevents clogging. Since each screw remains in the thread it has cut itself, a strong tight fastening, highly resistant to vibration, is always certain. The coarse pitch of the Shakeproof Type 25 Screw increases the difference between driving and stripping torques . . . a desirable safety factor in plastic applications.

Try this specially designed modern fastener for plastics—now!



Write for this free test kit!

SHAKEPROOF inc.

"Fastening Headquarters"

Distributor of Shakeproof Products Manufactured by ILLINOIS TOOL WORKS
2501 North Keeler Avenue, Chicago 39, Illinois
Plants at Chicago and Elgin, Illinois • In Canada: Canada Illinois Tools Ltd., Toronto, Ontario

THE NEW *Norelco* 150 KV

TAKES X-RAY OUT OF THE LEAD-LINED ROOM AND PUTS IT TO WORK IN YOUR PLANT



Shockproof, rayproof and foolproof—Searchray Model 150 is so completely protected that anyone can safely operate it anywhere in your plant or laboratory without the necessity of a lead-lined room. Simplicity of operation is one of its outstanding features. It is a completely self-contained piece of industrial apparatus.

Searchray 150 discloses the internal structure of castings, plastics, hard rubber parts, ceramics, foods, canned goods, instruments, small electrical parts and many other materials and articles you may care to examine. Its applications in the plant and the laboratory are almost innumerable.

Searchray 150 will save you countless time and money. It will be an indispensable aid in making perfection a matter of certainty rather than guesswork, assurance rather than faith. It is not necessary to disassemble any part or object you examine, or to equip a special X-ray department—just put your object into the viewing compartment and position it for a radiograph or for fluoroscopic examination.

Searchray 150 operates at low cost. Its stepless kilovoltage selector permits ranges from 0 to 150 KV, 6 milliamperes. 220-volt 60-cycle AC.

Searchray 150 is only one of the many new Norelco electronic products designed to help industry. If you think Searchray 150 can help solve some of your problems, write today to North American Philips.

For our Armed Forces we make Quartz Oscillator Plates; Amplifier, Transmitting, Rectifier and Cathode Ray Tubes for land, sea and air-borne communications equipment. *For our war industries* we make Searchray (X-ray) apparatus for industrial and research applications; X-ray Diffraction Apparatus; Electronic Temperature Indicators; Direct Reading Frequency Meters; Tungsten and Molybdenum in powder, rod, wire and sheet form; Tungsten Alloys; Fine wire of practically all drawable metals and alloys: bare, plated and enameled; Diamond Dies; High Frequency Heating Equipment. *And for Victory we say: Buy More War Bonds.*

Norelco ELECTRONIC PRODUCTS by NORTH AMERICAN PHILIPS COMPANY, INC.

Industrial Electronics Division, 419 Fourth Ave., New York 16, N. Y.

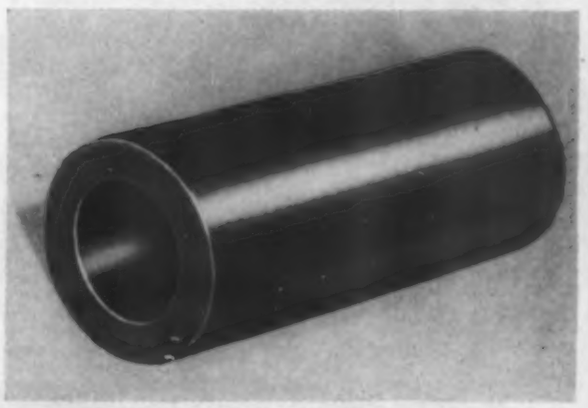
Main factory and offices in Dobbs Ferry, N. Y.; other factories at Lewiston, Maine (Elmet Division); Mount Vernon, New York (Philips Metalix Corporation). Represented in Canada by Electrical Trading Company, Ltd., Sun Life Building, Montreal, Canada



...ze and
...ized?

from as SMALL as this..

to as BIG as this..and



EVERY Size In Between!

Sandee

FLEXIBLE PLASTIC TUBING

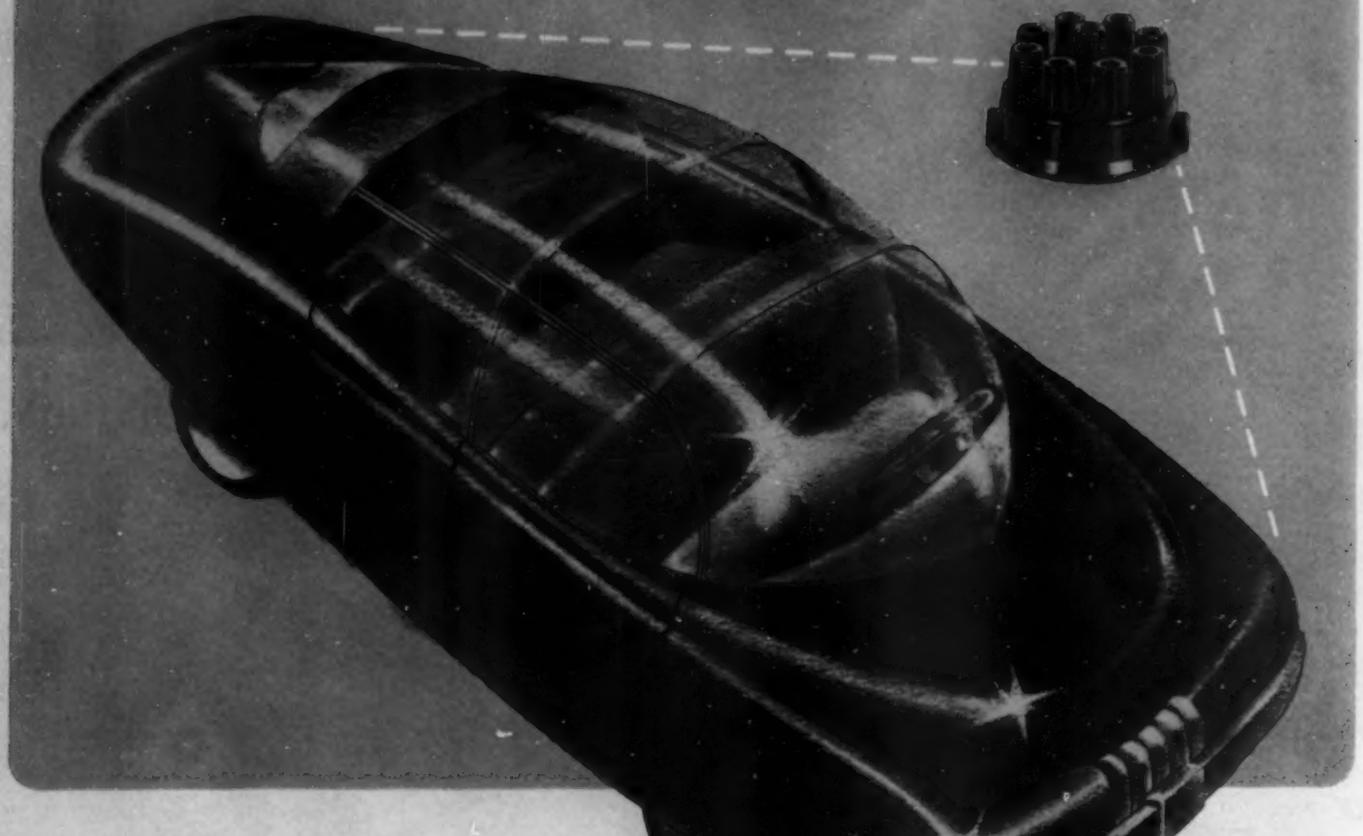
NO matter what size, thickness, length, color or degree of flexibility . . there's a SANDEE *Flexible* Plastic Tubing to meet practically every need. This versatile modern product has excellent insulating and non-oxidizing qualities which make it exceptionally well adapted for use with electrical products. Sandee tubing is used in communication equipment for our armed forces as cable and wire coverings, sheathing, sleeving insulation and electronic co-axial cables. Investigate, now, the many superior advantages of Sandee Plastic Tubing . . precision-made by long experienced plastics engineers. Send for samples and complete information ☆ Sandee also manufactures a large line of stock and custom-made extruded rigid plastic sections. Complete information on request.

Sandee Manufacturing Company

[illegible] WESTERN AVENUE [illegible]

EXTRUDED PLASTICS AND SPECIAL TOOLS

THERMEX makes today's small parts faster —tomorrow's giant moldings practical!



DISTRIBUTOR CAPS or PLASTIC CARS—whether it's a small molding *today*, or a plastic body for a post-war automobile — the job can be done *faster* and *better* with Thermex high frequency heating.

Thermex heats uniformly regardless of area or thickness . . . does the job in most cases within 15 to 60 seconds. By heating preforms with Thermex, over-all time cycles are reduced 50% or more . . . the output of a press is doubled. Better flow properties and less internal strain assures a stronger, more homogeneous structure. Pressure can be reduced as much as 80%.

Thermex can do *today's* jobs better, faster, easier . . .
. . . and is ready for the production jobs of *tomorrow.*

Write for further information.

The GIRDLER CORPORATION • Thermex Division • Louisville, Ky.

"Buy another War Bond this week!

THERMEX
HIGH FREQUENCY
HEATING EQUIPMENT
A GIRDLER PRODUCT

LENGTHENING SHADOWS OF PROGRESS

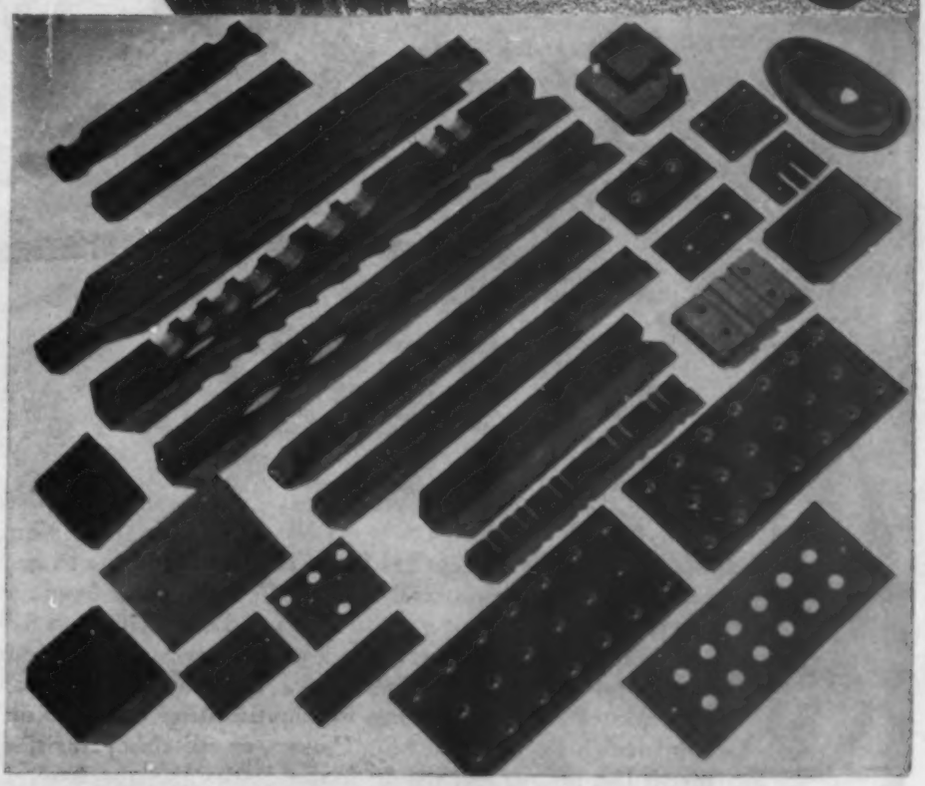
PHOTOS COURTESY PAN AMERICAN AIRWAYS



Today the Flying Clippers of Pan American Airways cast their shadows on the four corners of the earth, symbolically representing the lengthened shadows cast by the modest FOKKER F7, first used by Pan American in 1927 over the single route between Key West and Havana . . . They are the ever-lengthening shadows of progress.

With constant improvement, research and close collaboration with aviation design engineers, C-D Plastics are likewise casting an ever-lengthening shadow of sure progress in the field of aviation. Without question C-D Plastics have played an important role among the many material advancements that have made possible today's flying giants. This progress has resulted in better plastics with greater mechanical, electrical and structural properties.

Illustrated are just a few of literally hundreds of parts now fabricated from DILECTO laminated phenolic plastics for use in modern airplanes. The knowledge and experience gained in designing these parts for aircraft applications are available to you . . . Use them to solve your "what material?" problem.



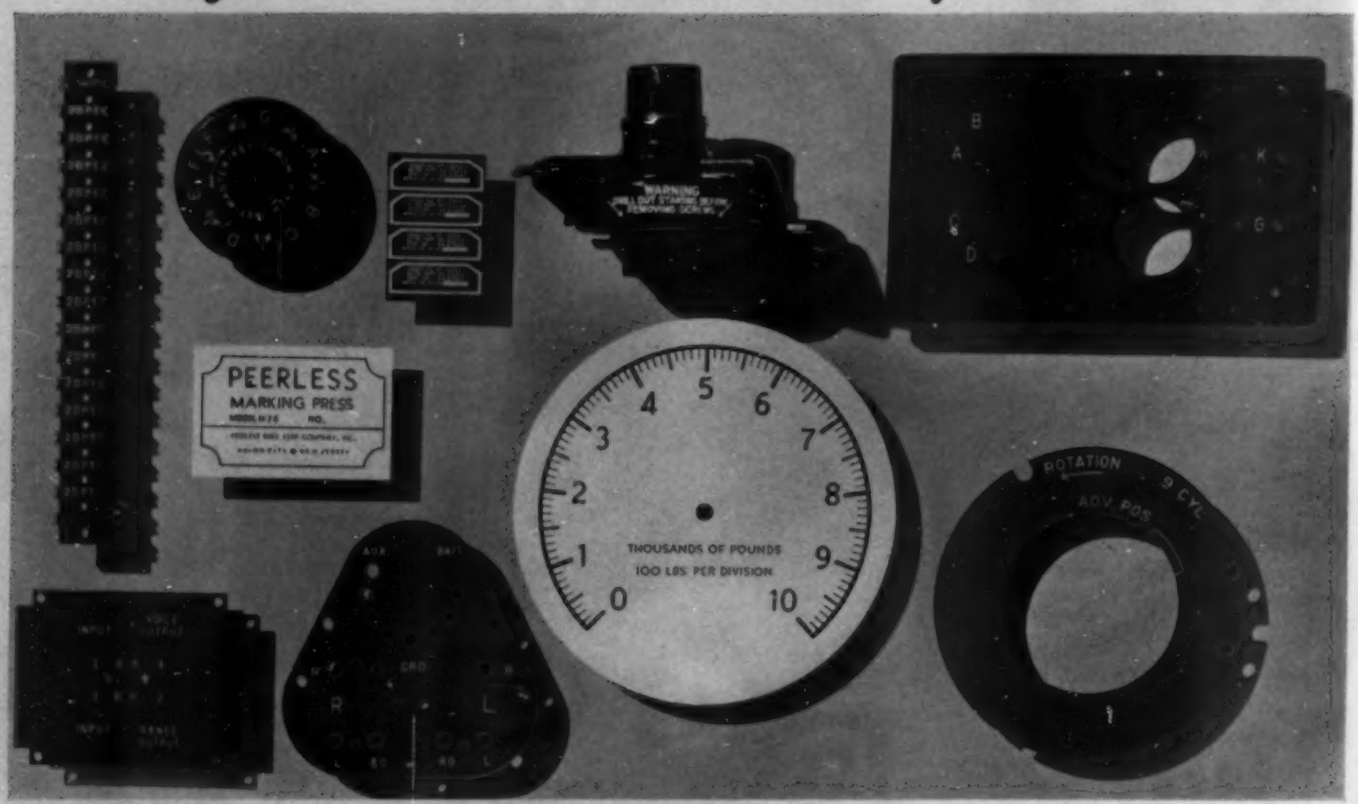
C-D products include THE PLASTICS . . . DILECTO—a laminated phenolic; GELORON—a molded phenolic; DILESTENE—a pure resin plastic especially suited to U-H-F insulation . . . THE NON-METALLICS, DIAMOND Vulcanized Fibre; VULCOID—resin impregnated vulcanized fibre; and MICABOND—built-up mica insulation. Folder GF describes all these products and gives standard sizes and specifications.

DISTRICT OFFICES: New York - Cleveland - Chicago - Spartanburg, S. C.
West Coast Rep., Marwood, Ltd., San Francisco - Sales Offices in principal cities

Continental - Diamond FIBRE COMPANY

Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

a method of marking plastics fitted to wartime production



THE PEERLESS PROCESS

The ideal method for marking plastic parts and products for lifetime identification. The Peerless Process is as permanent as engraving but as fast as printing... One operation of a Peerless Roll Leaf Hot Stamping Press engraves the lettering or design into the material and transfers the color from a convenient dry roll of stamping foil. You cut out old fashioned engraving and filling-in operations and eliminate drying time entirely. You can mark flat or cylindrical parts...in white, black, gold, silver, and other colors. It is an ideal process for producing plastic nameplates and for striking in identification numbers on finished plates...We can furnish Peerless Marking Presses, on suitable priorities, to meet any requirement. If your present needs do not justify the purchase of complete equipment for your own plant, our War Contracts Division can arrange to do the work for you. *Write today for full information.*

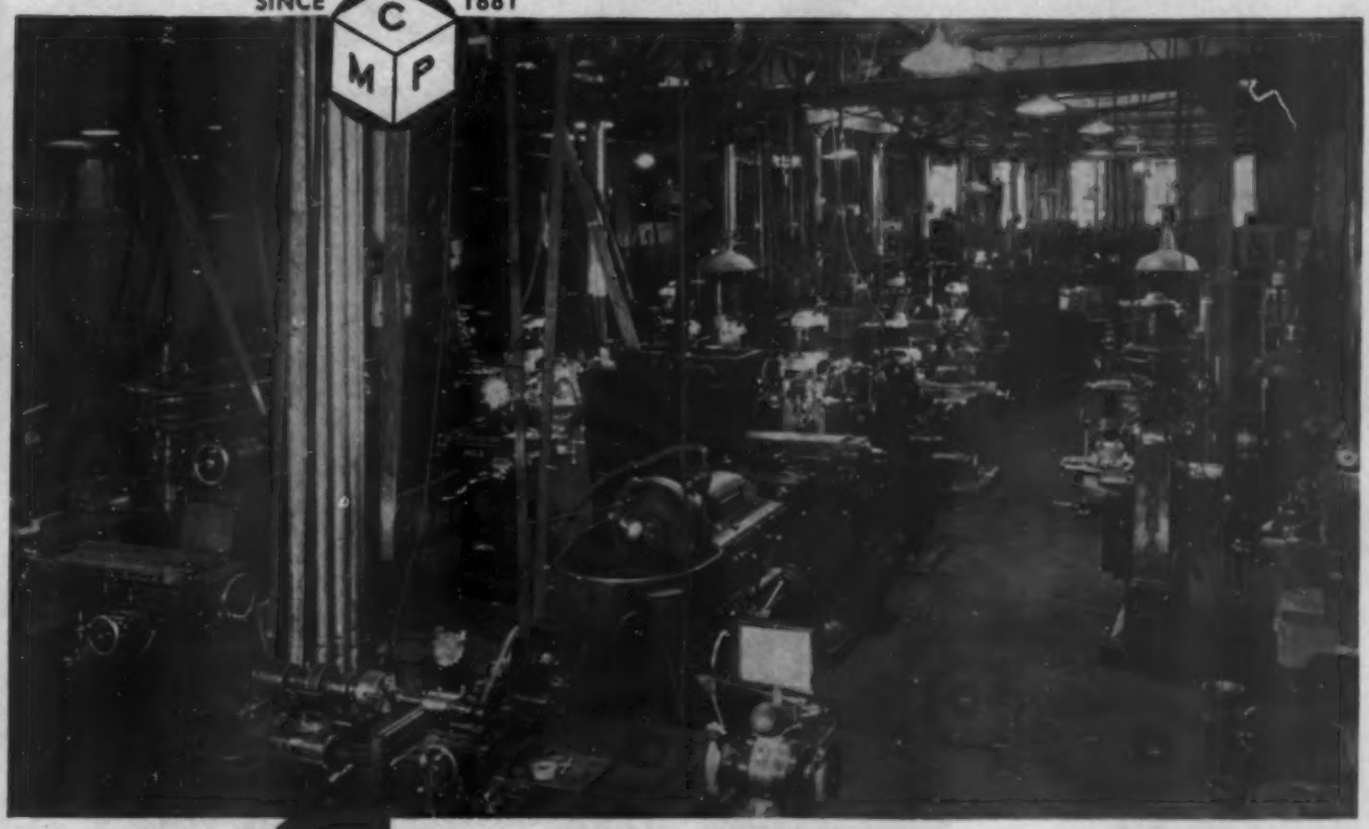
PEERLESS ROLL LEAF COMPANY, INC.
4511-4513 New York Ave., UNION CITY, N. J.

"Your Blueprint in Plastic"



Whenever we escort visitors through the Consolidated plant, they linger longest in the tool and die-making wing. It is a most impressive sight to watch die metal being worked. Here, Consolidated's tool craftsmen exemplify patient application. Steel gives way slowly—but knowing that it gives way surely, these men control each step with trained eyes and skilled hands. Theirs is a responsible role, for by their precision achievements, we guarantee "Your Blueprint in Plastic".

SINCE C M P 1881



Consolidated

Molded Products Corporation



309 CHERRY STREET, SCRANTON 2, PA.

NEW YORK
1790 Broadway

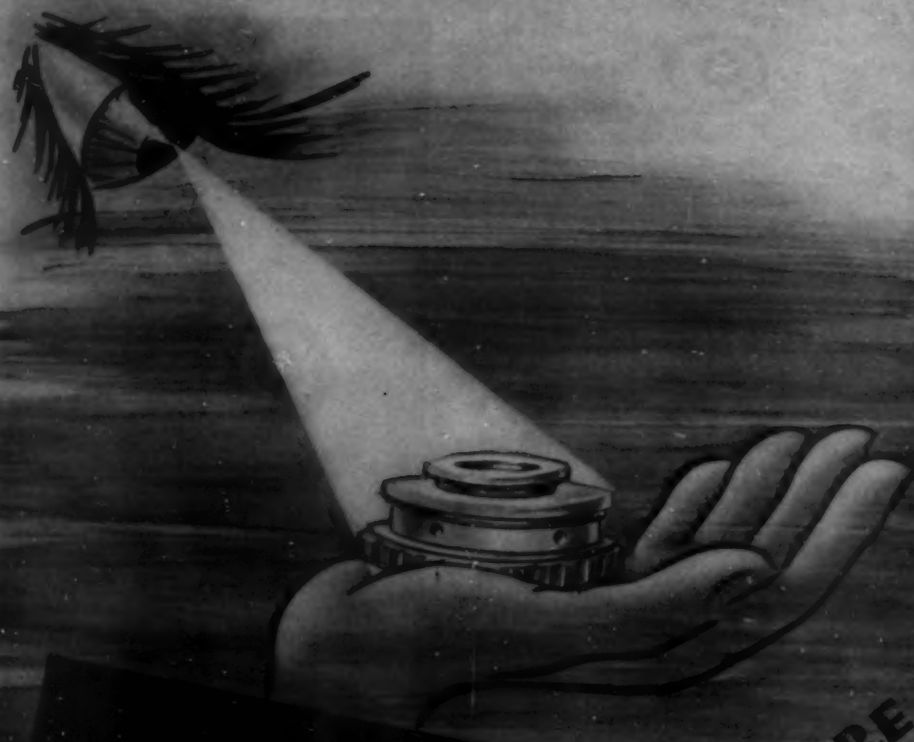
BRIDGEPORT
Rocky Ridge Drive

CLEVELAND
3682 Ingleside Road
(Shaker Heights)

DETROIT
2970 West Grand Blvd.

CHICAGO
549 West Randolph St.

ENTIRE CONTENTS COPYRIGHTED 1943, CONSOLIDATED MOLDED PRODUCTS CORPORATION



OUR INSPECTION DEPARTMENT IS MORE CRITICAL THAN YOURS

PLASTICS

by the ARNOLD BRILHART COMPANY means *every* piece according to specifications... NO REJECTS!

We specialize in helping both the large and small company solve their difficult problems in plastics.

ACCURATE MACHINING - INTRICATE MOLDING
SPECIAL DESIGN - QUALITY PRODUCTION.

Brilhart

Please state preference rating with all inquiries

ARNOLD BRILHART COMPANY • 435 MIDDLENECK ROAD • GREAT NECK, N.Y. • *Phone* GREAT NECK 405



(Photo Courtesy Pan American Airways System)

They cover the water-front



A—Sawed, milled, drilled and bored Brush Ring. B—Sawed, sanded and drilled Insulating Plate. C—Threaded and tapped Reducing Bushing.

OVER the Atlantic, the Pacific . . . over all the vast reaches of America's water-front, the Clippers are winging on errands of war, mercy and business. Of many parts made from Synthane for the Clippers, probably the most important are those for radio and electrical instruments.

Synthane is valued in the air service for its many combined properties—light weight, for instance (half the weight of aluminum), excellent insulating characteristics, hardness, ease of machining, resistance to corrosion from aviation oils and gasoline, and mechanical strength.

Synthane now is confined to essential work, but new materials and applications are in the making. Keep up-to-date with information such as you will find on the back of this and future sheets.

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA

Plan your present and future products with Synthane Technical Plastics

SHEETS • RODS • TUBES • FABRICATED PARTS

SYNTHANE

Bakelite— laminated

MOLDED-LAMINATED • MOLDED-MACERATED

KEEP POSTED WITH THIS NEW PAGE OF INFORMATION ON

SYNTHANE Molded-Laminated and Molded-Macerated Product

Many of you are already familiar with the manufacture, uses and properties of SYNTHANE Bakelite-laminated. You perhaps know that it is made from paper or fabric impregnated with a plastic resin and transformed under heat and pressure into a hard, dense material of many combined properties.

Laminated materials are produced in the form of sheets, rods and tubes, usually requiring some machining to finished form.

There are two associated forms of SYNTHANE which reduce or eliminate the necessity for machining—known as molded-laminated and molded-macerated SYNTHANE.

Molded-Laminated

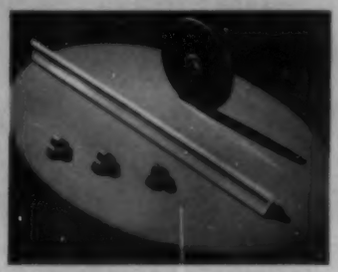
Frequently it is economical to produce finished products by a combination of molding and laminating techniques. Laminations of the impregnated paper or fabric are cut to the rough outline of the desired piece and molded under heat and pressure to finished form. The result is a product with approximately the strength of SYNTHANE Bakelite-laminated without machining time or expense. Obviously, the quantity of pieces required must be sufficient to justify the costs of molding, including the cost of the mold itself, as compared with the costs of regular laminated material and machining. Obviously, too, there are certain limitations to the application of the molded-laminated process. If shapes are intricate, it may not be practical to cut the laminations to fit the mold. Molded-macerated construction may then be the answer.



Molded-macerated cap and base for explosives container.



Molded-macerated gasket and spool.



Combination molded-laminated-macerated wheel. Molded-laminated distributor arms.



Molded-laminated horn for carbon dioxide fire extinguishers.

Molded-Macerated

The molded-macerated procedure is similar to molded-laminated except that the impregnated paper or fabric is chopped into small flakes or chips before the mold is charged. The flakes, being comparatively small, allow considerably more latitude in the shape and complexity of the mold than is possible with the molded-laminated process.

Naturally, impregnated flakes do not have the flow characteristics of molding powder. Therefore, it is wise to avoid undercuts or pins which are perpendicular to the direction of the molding pressure (generally vertical). Side holes and undercuts may be more satisfactorily machined.

Properties

Both the processes described bear some resemblance to powder molding except that molded-laminated or molded-macerated articles have far greater mechanical strength than powder moldings. Molded-laminated material approaches laminated material in strength; molded-macerated has about 50 to 75% of the mechanical strength of corresponding laminated grades. The mechanical, electrical, physical and chemical properties can be varied over a wide range or adjusted one against the other to meet specific needs just as is the case with laminated materials.

Combination Molded-Laminated-Macerated

It is possible to combine the benefits of molded-laminated and molded-macerated into one molding where maximum strength in one section and maximum resin flow in another are necessary.

Methods Used for Testing Synthane

(1) Tests were made on ⅛" thick ness, at room temperature, approxi mately 25 deg. C., following the American Society for Testing Materials Method D-229-42.

(2) Tests were made on tension tes specimen, at room temperature, ap proximately 25 deg. C., following the American Society for Testing Materials Method D-48-42T.

(3) Tests were made under oil o 1/16" thickness, according to America Society for Testing Materials Metho D-149-40T.

(4) Tests were made under oil o disc 4" diameter and ⅛" thick, ac cording to American Society for Test ing Materials Method D-48-42T.

(5) Tests were made on pieces 3" 1" x ⅛" thick according to the Ameri can Society for Testing Materials Method D-229-42 after immersion i water for 24 hours at approximatel 25 deg. C. plus or minus 2 deg. C.

(6) Tests were made on molde discs 2" diam. x ⅛" thick accordin to the American Society for Testin Materials Method D-48-42T.

(7) Tests were made on notche specimens 2½" x ½" x ½" thic according to the American Society fo Testing Materials Method D-256-41

(8) Tests were made on specimen used for water absorption tests ac cording to the American Society fo Testing Materials Method D-634-41

(9) Tests were made on specimen 1" x 1" x ½" thick according to th American Society for Testing Ma terials D-229-42.

Comparison of Synthane Molded-Laminated and Molded-Macerated with Synthane Standard Grade C Laminated

	GRADE C LAMINATED	GRADE C MOLDED-LAMINATED	GRADE C MOLDED-MACERATED
TENSILE STRENGTH Lbs./Sq. In.	(1) 9,500	(1) 8,200	(2) 7,800
FLEXURAL (TRANSVERSE) STRENGTH Lbs./Sq. In.	(1) 20,000	(1) 17,000	(2) 12,000
COMPRESSIVE STRENGTH Lbs./Sq. In.	(1) 38,000	(1) 32,000	(2) 27,000
DIELECTRIC STRENGTH Volts per Mil (.001") Short-Time Test	(3) 200	(3) 180	(4) 180
Step-by-Step Test	120	110	110
% MOISTURE ABSORPTION	(5) 1.7	(5) 1.9	(6) 1.0
IZOD IMPACT STRENGTH (Flatwise) Ft.-Lbs./In. of notch	(7) 3.2	(7) 2.7	(7) 2.2
(Edgewise)	2.0	1.7	1.7
SPECIFIC GRAVITY	(8) 1.36	(8) 1.36	(8) 1.36
ROCKWELL HARDNESS	(1) M110	(1) M110	(1) M110
BONDING STRENGTH—Lbs.	(9) 2400	(9) 2000	(9) 2000



Molded-macerated collar and spool.



Molded-macerated handwheel and for for V-belt pulley.

PLAN YOUR PRESENT AND FUTURE PRODUCTS WITH SYNTHANE TECHNICAL PLASTICS

SYNTHANE

Bakelite— laminated

SHEETS-RODS-TUBES-FABRICATED PARTS-MOLDED-LAMINATED-MOLDED-MACERATED

SYNTHANE CORPORATION, OAKS, PENNA.

REPRESENTATIVES IN ALL PRINCIPAL CITIES

RIEGEL-X

A group of plain and impregnated base papers for both fluid and direct pressure plastic laminates.

X

We now announce and offer to the entire trade, a line of base papers for plastic laminates...a field in which we have pioneered and in which we have been doing business for some time with many important operators. This follows our usual policy of never publicly offering a new product until it is so firmly established that no prospective customer shall serve as a guinea pig for our research and development.

X

Tested and approved by all leading plastic laboratories, RIEGEL-X papers have been used commercially in many plants, many months. The finished products are now in service on land, at sea and in the air in every theatre of the war.

X

This is a field of immediate national importance with tremendous post-war opportunities. You should become acquainted with the facts we have gathered from the inception of this revolutionary new material. There are standard, tested and approved RIEGEL-X papers available for delivery now. Write for data and samples.

RIEGEL PAPER CORPORATION

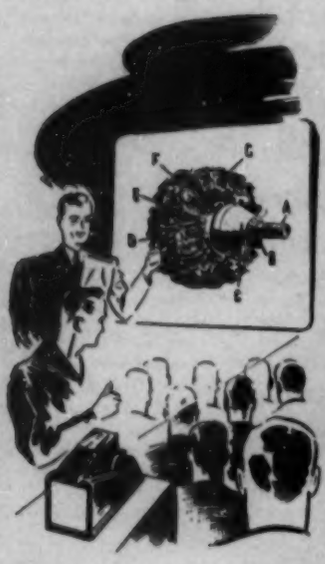
342 MADISON AVENUE, NEW YORK 17, N. Y.

X

89

Plastic Magic

TRANSFORMED YESTERDAY'S "MAGIC LANTERN" INTO TOMORROW'S SLIDE PROJECTOR





Pictured here is the sleek and streamlined Novex Viewer-Projector. With the upper section depressed, as in the large illustration, the Novex casts an image of slides, dental X-ray films or color films upon the frosted glass pane for ready viewing. Raise the upper section, and the view is projected onto a wall or screen.

Remember the rickety, smoky "magic lantern" of boyhood days? Look what *plastics* has done for the design . . . and the *utility* . . . of this device!

Here is a sterling example of what can be achieved with the unique properties of *plastics* . . . *plus design, engineering and production "know-how."* For instance, the main housing is *big* . . . 14"¾ x 9½" x 7⅝" to be exact . . . and has to be rugged. Reinforcing ribs had to be properly located and the mold design carefully worked out to permit economical production. Dimensional stability was of utmost importance so that the upper and lower sections would assemble smoothly. Complex internal members hold the bulb, lense assembly and reflecting mirror in permanently correct alignment.

The finished product represents an eminently satisfactory solution of a difficult assignment. We can similarly assist you in the design and production of plastic parts or products. Send us your specifications for quotations, or have one of our engineers consult with you. MOLDED PRODUCTS COMPANY, 4533 W. Harrison St., Chicago (24), Ill.

PLASTICS DIVISION

MOLDED MPC PRODUCTS



Still the Toughest of them all...

NITROCELLULOSE PLASTICS

Windshields for motorcycles illustrate the many important properties of nitrocellulose plastics. Exceptional transparency. Dimensional stability. Toughness. Water resistance. Resiliency. Easy fabrication.

These are the outstanding features of nitrocellulose plastics . . . the toughest of all thermoplastics . . . which make them indispensable for wartime and civilian products. Hercules Powder Company manufactures no finished pyroxylin plastics, but concentrates on the production of those forms of nitrocellulose most suitable for its customers' products.

Investigate the unique advantages and low cost of nitrocellulose for plastics by writing to Department MP-13.

CELLULOSE PRODUCTS DEPARTMENT

HERCULES POWDER COMPANY

INCORPORATED

916 MARKET STREET • • WILMINGTON, DELAWARE

NITROCELLULOSE FOR PLASTICS

NEW ORBITAL MULTI-DIRECTIONAL SANDING PRINCIPLE GIVES BETTER RESULTS IN

FINISHING
LAPPING
POLISHING
RUBBING
SANDING



New Orbital Principle

As shown above, with the Sterling 1000, each grain cuts a microscopic furrow 3/16" in diameter. The furrows cross and re-cross each other, cut at the rate of 4500 per minute, each at the same speed and at the same time, achieving a degree of uniformity and smoothness never possible with conventional, uni-directional sanding methods.

USE THE STERLING 1000 FOR THE SMOOTHEST, CLEANEST, MOST UNIFORM SURFACE

In contrast to conventional uni-directional sanding methods, the NEW multi-directional, or orbital, principle employed by the STERLING 1000 provides a versatility and a degree of surface smoothness never before possible to achieve, by mechanical means, on wood, metal, plastics, plywood, stone and other materials. It will pay you to get full particulars *now* as to how the Sterling 1000, operating on an entirely new principle, will cut costs and speed production in your plant.

STERLING TOOL PRODUCTS COMPANY

382 E. Ohio Street, Chicago 11, Illinois

615 W. Washington Blvd., Los Angeles, Calif.

74 Wellington Street, W., Toronto, Canada

YOU'RE NOW ON THE HORIZON OF A BRAND-NEW WORLD FOR

PLASTICS

The Plastics Industry is standing on the crest of the hill overlooking the vast, new world of tomorrow in which Plastics will play a vital role! Forecasts of the future uses of Plastics may sound fantastic today . . . but in the light of reality they may actually turn out to be conservative estimates, indeed.

Only two factors can actually reveal what the future holds for Plastics . . . Time and Science. If you wait for Time, you'll be on the tail-end of the bandwagon. For the pioneers and leaders of the industry are employing Scientific Testing, right now, to point the way to new uses for Plastics . . . to map out plans for capitalizing the tremendous new developments in the offing.

The following special Plastics Tests are invaluable in revealing the potentialities of your Plastics for numberless new uses and products:

- Impact Strength
- Tensile Strength
- Flexural Strength
- Compressive Strength
- Bending Test
- Shear Test (Johnson Shear Tool)
- Rockwell Hardness
- Thickness
- Density
- Distortion Under Heat
- Specific Heat
- Thermal Expansion
- Flammability
- Color Fastness
- Resistance to Chemical Reagents
- Acetone Extraction
- Hot Oil Test
- Water Absorption
- Dielectric Strength
- Power Factor and Dielectric Constant
- Volume Resistivity
- Thermal Conductivity
- Arc Resistance
- Mold Shrinkage

All Plastics Tests are performed in an air conditioned room under a controlled temperature standardized at 77 degrees F. with 50% humidity. For special tests we can adjust temperature from —70 degrees F. to 160 degrees F.

We shall be glad to estimate the cost of tests if complete information is furnished as to the exact data desired. Write.

* Member of A. C. C. L.

UNITED STATES TESTING COMPANY, INC.

* American Council of Commercial Laboratories

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

PHILADELPHIA, PA. GREENSBORO, N. C. WOONSOCKET, R. I. CHICAGO, ILL. NEW YORK, N. Y.

HYCON High Pressure Hydraulic Systems

Can solve many of your design, production and testing problems

Complete systems with accurately controlled pressures up to 3000 lb. per sq. in.



STANDARD EQUIPMENT FOR IMMEDIATE DELIVERY

•

Catalogues on request

Engineering Staff available for layout

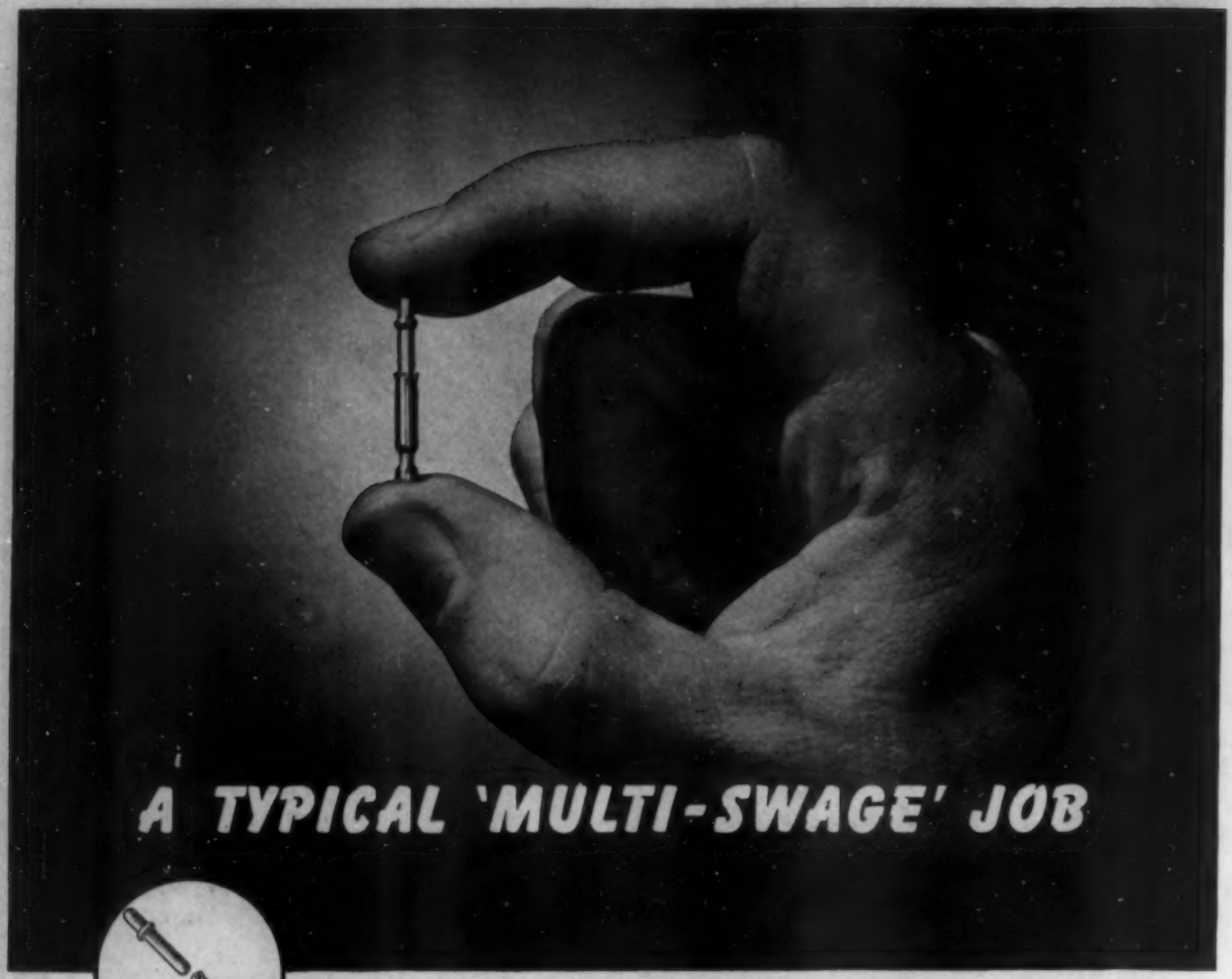
HYCON positive displacement radial piston pumps are built in two sizes: Model K—125 cu. in. per minute; and Model L—250 cu. in. per minute at 1750 RPM. These pumps are built for self-lubrication from the hydraulic circuit, or can be furnished for separate crankcase lubrication for pumping any non-corrosive fluid with reasonable lubricating characteristics for upper cylinder protection. Continuous operation at 3000 p.s.i.

THE NEW YORK AIR BRAKE COMPANY

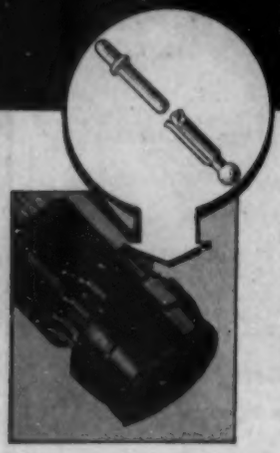
Hydraulic Division

420 Lexington Avenue, New York 17, N. Y.


Meeting the Toughest Tests
OF WAR
MODERN WAR is an exacting tester of materials as well as of men. In the test tube of front line service, essential equipment employing REILLY PLASTICS is meeting the toughest requirements of war—on every front.
Light weight, superior mechanical strength and insulating qualities, and dependable protection against heat, moisture, oils and acids are among the characteristics that are enabling REILLY PLASTICS to make a vital contribution to the performance of many different types of war equipment.
REILLY TAR & CHEMICAL CORP.
MERCHANTS BANK BUILDING, INDIANAPOLIS
500 Fifth Avenue
New York City
2513 South Damen Ave.
Chicago, Ill.
Reilly
COAL TAR
PRODUCTS
17 PLANTS
to Serve the Nation
REILLY Plastics



A TYPICAL 'MULTI-SWAGE' JOB



Most of the radio tube contacts used today are made by the BEAD CHAIN MULTI-SWAGE PROCESS.

The radio tube contacts shown above typify the precise, high-speed, volume production of small metal parts possible by the BEAD CHAIN MULTI-SWAGE PROCESS. These parts are formed from flat stock, practically without waste . . . a feature of all MULTI-SWAGE jobs which results in substantial economy in the cost of the finished product.

A great variety of similar parts, solid or hollow, can be produced advantageously by MULTI-SWAGE. Large quantities can be turned out quickly. Most metals can be processed by MULTI-SWAGE.

Right now, our MULTI-SWAGE facilities are running full-time on war work. But, if you are planning post-war products using hollow, or solid round, cylindrical or angular parts, our Research and Development Division will gladly show you the advantages of making them by MULTI-SWAGE.

BEAD CHAIN
multi·swage
PROCESS

THE MOST ECONOMICAL METHOD OF PRODUCING SMALL METAL PARTS TO CLOSE TOLERANCES WITHOUT WASTE

THE BEAD CHAIN MANUFACTURING COMPANY

MOUNTAIN GROVE AND STATE STS., BRIDGEPORT 5, CONN.



A plastic provides the transparency and light weight desired for industrial goggles. But it was necessary to add stiffness to the frames and durability to the threads which hold the lenses in place without sacrificing light weight. Aluminum inserts, with threads cut in them, take care of these requirements.

It's another case of plastics and aluminum teaming up to do a job which neither could do as well alone. It's a combination you'll find duplicated many times in combat aircraft.

Because no single material possesses all of the characteristics needed to meet every problem of design, you are going to see a lot of this teamwork as postwar products appear. New markets will be opened up. Users will get finer, more useful products.

Aluminum, in its many forms, offers definite advantages as inserts in plastics and is easy to adapt to the processes in which the two materials are teamed up. Aluminum offers you high strength and hardness with low weight, ease of fabrication, resistance to many types of corrosion, fine appearance. Alcoa engineers will lend you their assistance in taking advantage of these properties. ALUMINUM COMPANY OF AMERICA, 2175 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM



Contributing to that under the surface quality of laminated plastics, is that high degree of uniformity found in MT. VERNON fabrics. Uniformity permits more careful processing . . . more uniform penetration . . . more complete fusion of fabrics and chemicals used. Modern laboratory control guides every step in the production of MT. VERNON fabrics. A skill developed through more than fifty years industrial fabric making experience contributes its important part to winning for MT. VERNON fabrics their respected place among leading industrial fabrics.

MT. VERNON WOODBERRY MILLS, INC.

TURNER HALSEY COMPANY
Selling Agents
40 WORTH STREET ★ NEW YORK, N. Y.
CHICAGO · NEW ORLEANS · ATLANTA · BALTIMORE · BOSTON · LOS ANGELES · SAN FRANCISCO

PROVING EVERY DAY

that . . . accurate physical testing is the prime requisite for choosing materials for war-time or post-war products.

Tinius Olsen Testing Machine Company recognizes its responsibility to the men who are, or will be given the task of making post-war plans come true — at minimum cost and in the shortest possible time.

Today is not too soon to begin to analyze critically the testing and balancing equipment which Olsen has developed as the accepted means to the proper material in the right place on time.

Feel free to write for literature on any of the Olsen equipment listed at the right—for metals and plastics.

Just off the press . . .
OLSEN BULLETIN No. 26
Static and Dynamic Balancing Machines described in detail as to function, operation and construction.

OLSEN PRODUCTS

UNIVERSAL TESTING MACHINES

TESTING MACHINES FOR
HARDNESS IMPACT STIFFNESS DISTORTION
DUCTILITY TORSION PLASTIC FLOW TRANSVERSE

INSTRUMENTS INCLUDING
EXTENSOMETERS PROVING RINGS RECORDERS
STRAIN GAUGES TENSIOMETERS DYNAMOMETERS

STATIC-DYNAMIC BALANCING MACHINES

MACHINES AND INSTRUMENTS DESIGNED AND BUILT TO MEET SPECIAL REQUIREMENTS

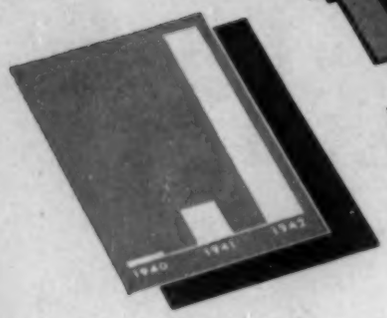
PROVING EVERY DAY THAT THE VALUE OF TESTING DEPENDS ON THE QUALITY OF THE TESTING EQUIPMENT.

TINIUS OLSEN TESTING MACHINE COMPANY

580 NORTH TWELFTH STREET, PHILADELPHIA 23, PA.

REPRESENTATIVES: **PACIFIC SCIENTIFIC COMPANY, Los Angeles, San Francisco, Seattle**
MINE and SMELTER SUPPLY COMPANY, Denver, Colorado.

The Story of TULOX and INTERLOX



THREE YEARS AGO we built a plant designed, equipped and tooled especially for the manufacture of fine-quality extruded plastics by our own *exclusive* processes. These processes have enabled us to produce tubing that is strain-free, also to produce both tubing and complicated shapes to closer tolerances than have been available heretofore.

TULOX Seamless Tubing and INTERLOX Functional and Industrial Shapes not only have effected untold economies in wartime replacement of critical war materials; they have, because of their superior qualities, built for themselves a permanent place in post-war industry.



SCIENCE PROVES TULOX FREE FROM STRAIN

This photograph shows the stress patterns in two leading types of plastic tubing. The section in the center was molded by conventional process and shows a veritable conflict of strains. The others are TULOX Seamless Plastic Tubing, extruded by our exclusive processes – and show an almost complete absence of strain! This is characteristic of all TULOX and INTERLOX products.

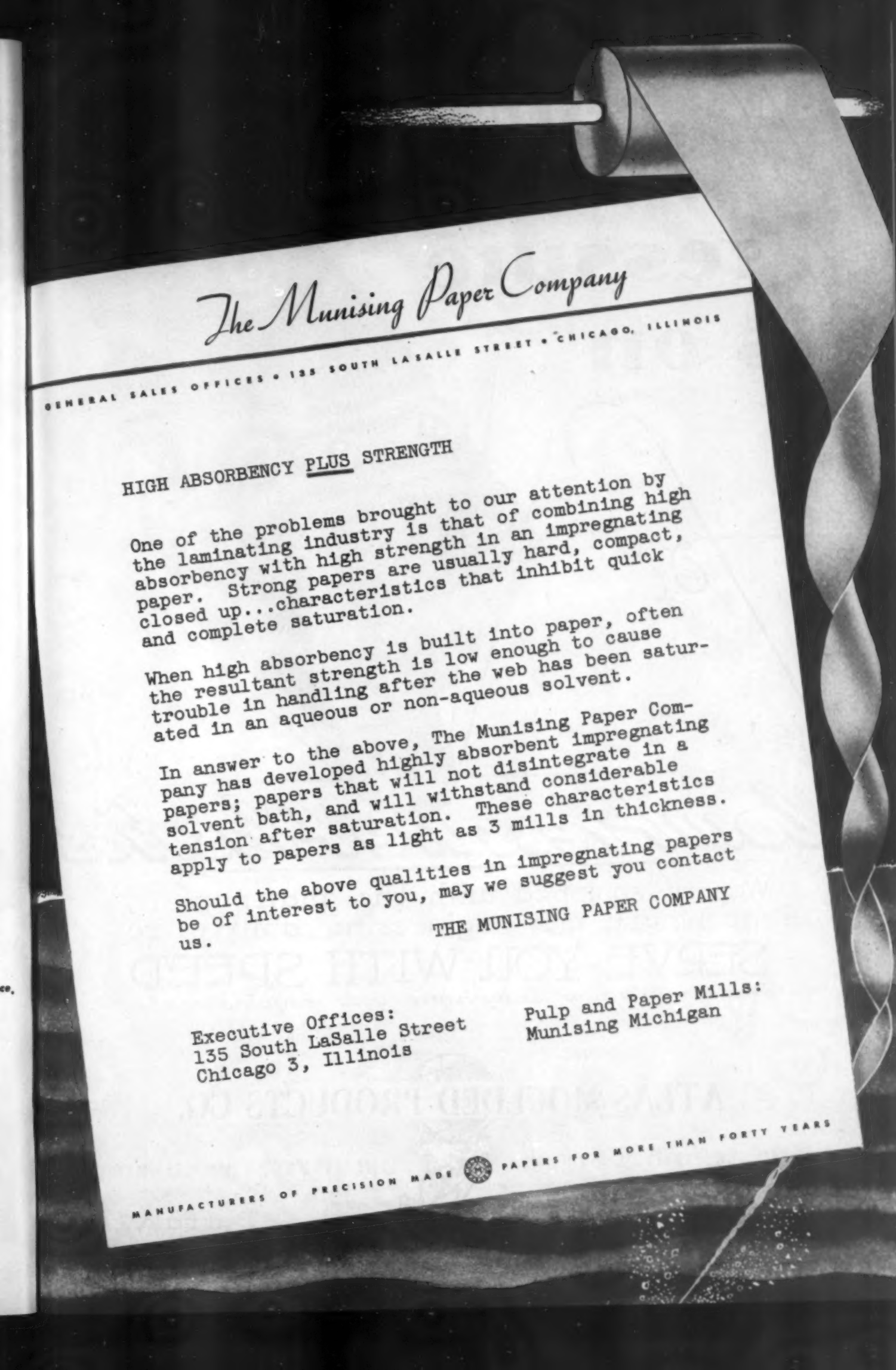
TULOX TT Tubing—made from Cellulose Acetate Butyrate—3/16" to 2" O.D. is available today from warehouse stocks for direct war use on high priority. TULOX V Flexible Tubing—to order only.

Our processes make possible many *unusual* shapes: Internally and externally ribbed round tubing. "Twin Tubes"—tubing with partition down center. Rectangular, Square and Hexagonal tubing.

Today these are furnished to specification only for direct war use. They are not stock products. *Tomorrow* they will play an important role in many phases of industry, not as war-time substitutes, but as materials superior to those they are replacing.

Research continues at all times, and we are glad to give our customers the benefit of our laboratory and manufacturing experience.

EXTRUDED PLASTICS, Inc.
NEW CANAAN AVE., NORWALK, CONN.



The Munising Paper Company

GENERAL SALES OFFICES • 135 SOUTH LASALLE STREET • CHICAGO, ILLINOIS

HIGH ABSORBENCY PLUS STRENGTH

One of the problems brought to our attention by the laminating industry is that of combining high absorbency with high strength in an impregnating paper. Strong papers are usually hard, compact, closed up...characteristics that inhibit quick and complete saturation.

When high absorbency is built into paper, often the resultant strength is low enough to cause trouble in handling after the web has been saturated in an aqueous or non-aqueous solvent.

In answer to the above, The Munising Paper Company has developed highly absorbent impregnating papers; papers that will not disintegrate in a solvent bath, and will withstand considerable tension after saturation. These characteristics apply to papers as light as 3 mills in thickness.

Should the above qualities in impregnating papers be of interest to you, may we suggest you contact us.

THE MUNISING PAPER COMPANY

Executive Offices:
135 South LaSalle Street
Chicago 3, Illinois

Pulp and Paper Mills:
Munising Michigan

MANUFACTURERS OF PRECISION MADE PAPERS FOR MORE THAN FORTY YEARS

If the Pressure is on

for



Low Pressure Plastics

We are equipped with the manpower, machinery and engineering ability to

SERVE YOU WITH SPEED

Write · · Wire or Telephone your requirements

ATLAS MOULDED PRODUCTS CO.

33 Franklin Street Buffalo, 2, N.Y.

New Book of Revelations



On *advanced* Fastening Technique

This booklet will make any assembly engineer happy. Its 24 pages are filled with over 50 new assembly devices and methods that save critical material, reduce weight, conquer vibration loosening, shorten assembly time and lower net costs. The new fastenings illustrated in this book are already speeding up assembly of planes and other war equipment. • This literature will not only help you right now, but will also serve as a handbook in planning assembly short cuts for your post-war products. SPEED NUTS specified for the assembly of these products of the future will pay big dividends.

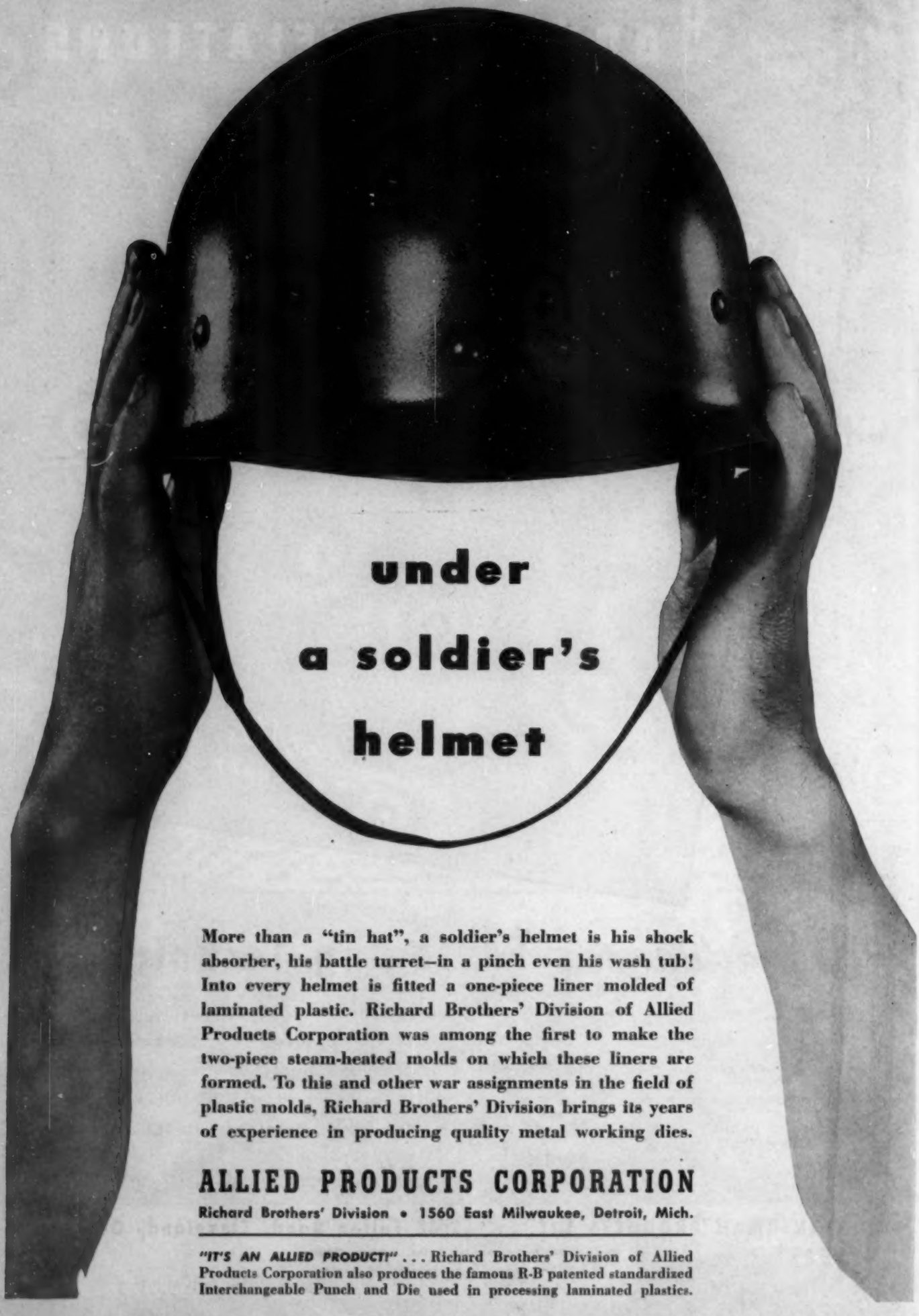
Write for your copy TODAY.

TINNERMAN PRODUCTS INC. • 2048 Fulton Road, Cleveland, Ohio

IN CANADA: Wallace Barnes Co., Ltd., Hamilton, Ontario
IN ENGLAND: Simmonds Aerocessories, Ltd., London

Speed Nuts

FASTEST THING IN FASTENINGS!



More than a "tin hat", a soldier's helmet is his shock absorber, his battle turret—in a pinch even his wash tub! Into every helmet is fitted a one-piece liner molded of laminated plastic. Richard Brothers' Division of Allied Products Corporation was among the first to make the two-piece steam-heated molds on which these liners are formed. To this and other war assignments in the field of plastic molds, Richard Brothers' Division brings its years of experience in producing quality metal working dies.

ALLIED PRODUCTS CORPORATION

Richard Brothers' Division • 1560 East Milwaukee, Detroit, Mich.

"IT'S AN ALLIED PRODUCT!" **. . . Richard Brothers' Division of Allied Products Corporation also produces the famous R-B patented standardized Interchangeable Punch and Die used in processing laminated plastics.**

PLAX *supplies in advanced forms a wide variety of* PLASTICS



	FIBER	SHEET	ROD	TUBING
CELLULOSE ACETATE	◢	◢	◢	◢
CELLULOSE ACETATE BUTYRATE	◢	◢	◢	◢
ETHYL CELLULOSE	◢			
METHACRYLATE			◢	
POLY ETHYLINE	◢	◢ NEW		
POLYSTYRENE	◢ *	◢ *	◢	◢
STYRAMIC		◢ NEW	◢	
	For cable wrapping and miscellaneous electronics use.	For electronic and electrical insulation, stampings, windows, etc.	For electronic component parts, etc.	For electronic conduits, component parts, etc.

PLAX
FOR PLASTICS
MOST SUBSTITUTES—IMPROVEMENTS
133 WALNUT STREET · HARTFORD 5 CONN.

Except for experimental work, this chart shows the complete line of Plax wartime production. In peace, Plax also makes blown plastic articles, high speed drawn items, fabricated parts, special shapes, etc., etc.

*Polystyrene is also available in the famous Polyflex† Fiber and Polyflex sheet, both really tough and flexible. (†The trademark POLYFLEX is Reg. U. S. Pat. Off.) For a bulletin on machining polystyrene and other helpful data, write the Plax Corp., 133 Walnut St., Hartford 5, Conn.

WE DISPERSE RESINS · GUMS AND MANY OTHER RUBBER-LIKE MATERIALS IN WATER





If you need an economical, rubber-like material for adhesives, cements, coating, dipping or impregnation, we probably have, or can develop for you, a water-dispersed elastomer or composition that will meet your specific requirements. Let us know what your problem is.

Dispersions Process, Inc.

symbolizing research and development in water (US) *dispersions*

(under management)

UNITED STATES RUBBER COMPANY

1230 Sixth Avenue, New York 20, N. Y.

PLASTIC BEARING

Cruver has engineered a simple but effective plastic bearing to replace the eyelet. It is held together by three screws caught in metal inserts.

A simple idea, and perhaps a small thing to talk about in relation to the huge contributions Cruver has made to various branches of the Armed Forces. Yet this bearing makes instruments last longer and work more effectively, enables them to be demounted for cleaning and to be adjusted to any desired tension.



Plastic bearing makes instruments last longer, operate better. Replaces metal rivet.



Cruver

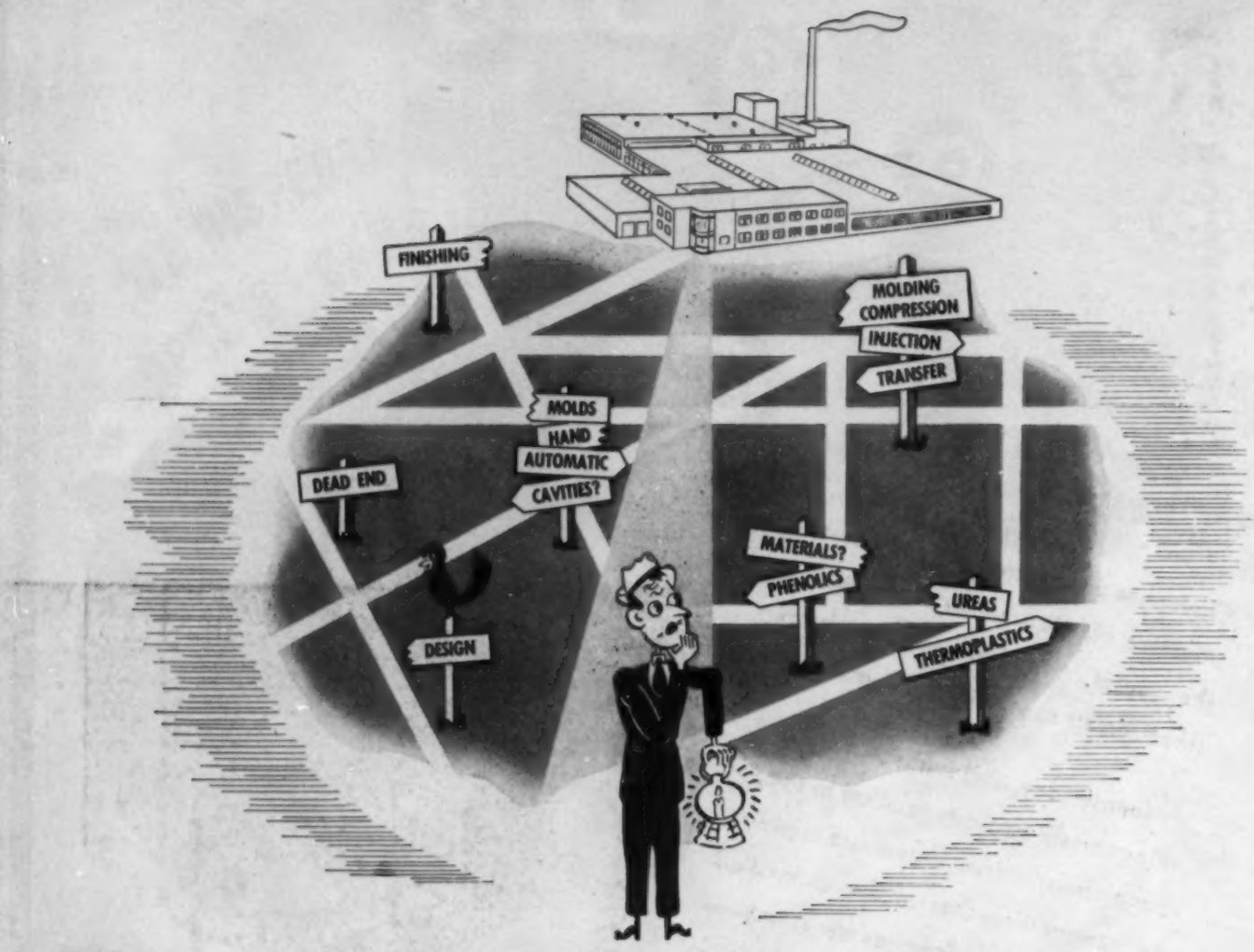
MANUFACTURING COMPANY

NEW YORK
2 West 46th St.
Wisconsin 7-8847

CHICAGO
2456 W. JACKSON BLVD.
Seeley 1300

WASHINGTON
Hotel Washington
Met. 5-900, Ext. 650

SPECIALISTS IN CONVERTING PLASTICS TO WAR



You want a guide instead of guide posts

when you're thinking Molded Plastics!

You'll find only one direct short-cut to uninterrupted delivery of satisfactory plastic parts — and that's right through the plant of a competent custom molder. The sheer, simple beauty of it is that it's so direct, easy and logical. It's a path to take today — to expedite post-war plans.

Your molder ***(taking ourselves as an example)*** **will:**

1. Cooperate in design and engineering, from the molding *and* end-use point of view.

2. Give sound, disinterested advice on the selection of molding materials — and Mister, there are over 200 basic molding compounds today, most of them divided into several special-purpose sub-categories!

3. Assume undivided responsibility for *every* operation — mold-making, molding and finishing (which ought to be parts of one job anyway, unless you enjoy scheduling, transportation and "buck-passing" snarls).

★ ★ ★

We offer the largest, best-equipped molding plant in the Middle West; the ability to assume full responsibility for planning and production and to so mesh our facilities with your manufacturing schedules that you will be assured of soundly-engineered, carefully-produced plastic parts on time. When you start planning that future job, ask for CMPC development engineer!

COMPRESSION, INJECTION AND TRANSFER MOLDING OF ALL PLASTIC MATERIALS

CHICAGO MOLDED PRODUCTS CORPORATION

1046 North Kolmar Avenue, Chicago 51, Illinois

BIRDS CAN'T FLY IN THIS SKY



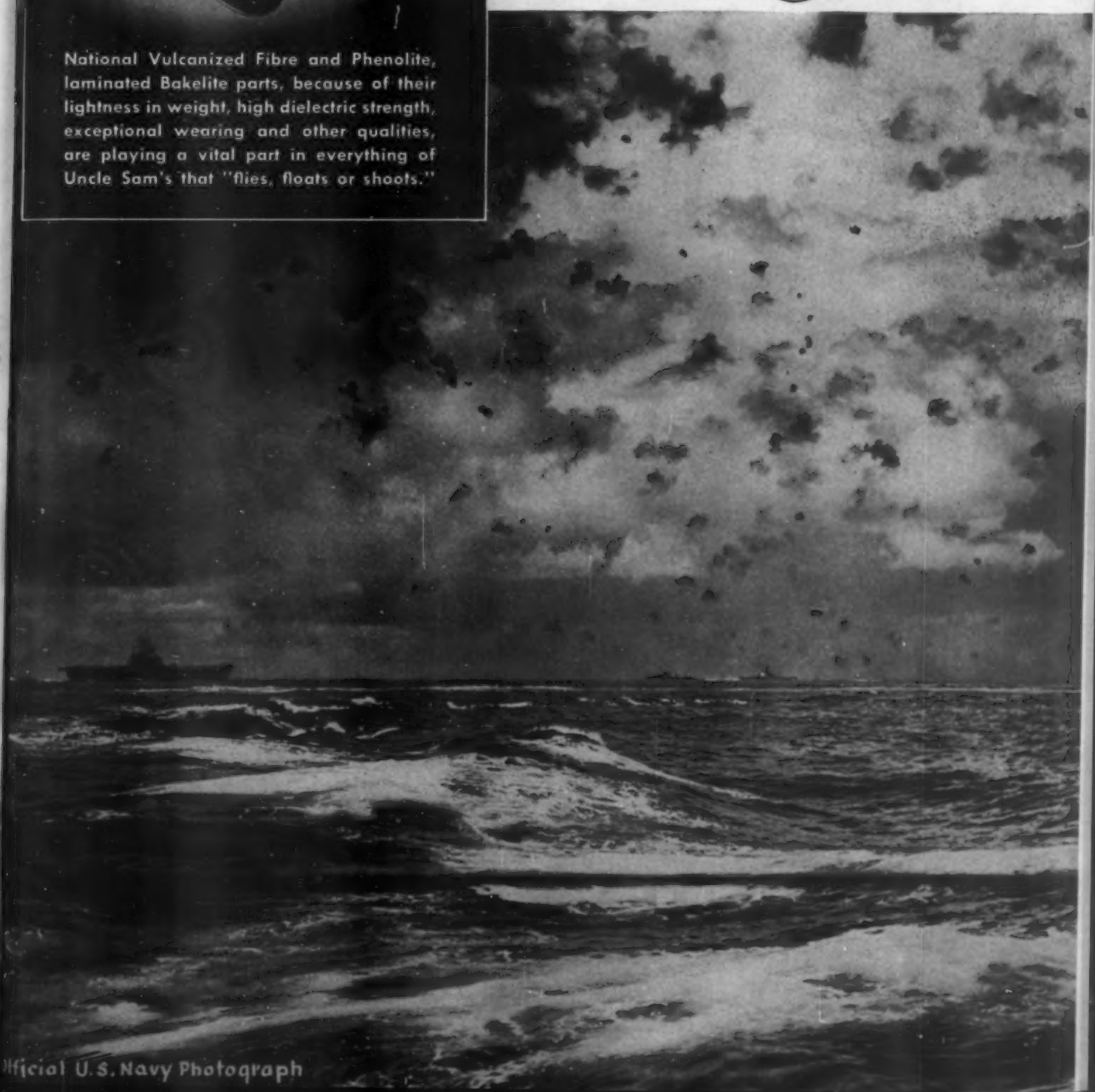
National Vulcanized Fibre and Phenolite, laminated Bakelite parts, because of their lightness in weight, high dielectric strength, exceptional wearing and other qualities, are playing a vital part in everything of Uncle Sam's that "flies, floats or shoots."

AND neither can the Japs who are attempting to bomb our "flat-top." The black-flecked sky in this dramatic picture, taken at the battle of Santa Cruz last October, shows the concentrated effectiveness of our anti-aircraft . . . proves the ability of our fighting men and weapons at sea. It is a challenge to us on the production front to "beat the record" . . . to give more blood to the Red Cross . . . buy more Bonds . . . do more in every way to get this job finished.

NATIONAL VULCANIZED FIBRE CO.

WILMINGTON DELAWARE

Offices in Principal Cities



Official U.S. Navy Photograph

Rich rewards in studying plastics



THE CURRICULUM INCLUDES ALL THESE

MOLDING—Study of Molding Materials and Flow Properties. Dependence of Properties of Materials Upon Methods of Molding.

MOLD DESIGN AND CONSTRUCTION—Fundamental Requirements of Thermosetting and Thermoplastic Composition in Molding.

CASTING—Materials Suited for Casting Purpose. Production Techniques Developed for Casting Phenolic Resins and Acrylic Resins.

LAMINATING—Procedure of Impregnating Fabrics, Paper, Asbestos and Wood.

TECHNIQUES OF FABRICATION—Thermoplastic Qualities of Plastic Materials.

TESTING—Why Plastics Differ from Other Materials of Construction and Wherein Test Methods Will Differ.

DESIGNING AND STYLING WITH PLASTICS

Historical Background. Polymerization Phenomena and the Formation of Plastics. Introduction to Organic Chemistry. Formation of Phenolic Plastics. Urea Resins and Their Characteristics. Polyvinyl Resins and Their Characteristics. Acrylic and Polystyrene Resins. Cellulose Plastics — Origin and Chemistry. Introduction to Cellulose Chemistry. Utilization of Farm Products and Waste Materials in Plastics. Synthetic Rubbers and Rubber-Like Materials. Electrical Properties of Plastic Materials. Chemical Properties of Plastic Materials. Optical Properties of Plastics. Styling and Art in Plastics.

★

NO pleasure driving—no bright lights downtown—you'll be home a lot this year, especially in the evenings. Instead of the monotony of extra time at home, lots of farsighted folks are making spare time hours pay dividends. They're investing evening hours in a plastics education—preparing for the future when *more* technical knowledge of plastics will be important to their career in this field.

The unusual Home Study plan of Plastics Institute is specially prepared to give you a practical education in plastics. A series of fully illustrated lessons parade the whole plastics world across your desk—included are 29 samples of plastics—you learn about materials—their applications, properties and limitations—methods of molding, laminating, fabricating and casting—design—testing—all the fundamental information of the complete engineering course. You also receive Plastics Trends, a fast moving publication on the new in Plastics.

Whether you are now in plastics or plan to enter this growing field—it will pay you to get complete information on the Plastics Institute Home Study lesson assignments. Write today for the new Booklet on "Rich Rewards in Plastics".

Plastics
INDUSTRIES TECHNICAL INSTITUTE

NEW YORK	LOS ANGELES	CHICAGO
1220-A Chanin Bldg.	182 S. Alvarado St.	626-A La Salle-Wacker Bldg.
Dept. 10	Dept. 10	Dept. 10

AMERICA'S ORIGINAL PLASTICS SCHOOLS

Francis A. Gudger, President
John Delmonte, Technical Director

ADVISORY BOARD
E. F. Lougee, Chairman

Donold Dew, Diemolding Corporation
Dr. Gordon M. Kline, National Bureau of Standards
Spencer E. Palmer, Tennessee Eastman Corp.
Louis M. Rossi, Bakelite Corporation

BETTER GROMMETS POINTED THE WAY TO THIS

Better Nipple



THE rubber shortage forced Auto-Lite's Bay Manufacturing Division into the manufacture of grommets from a synthetic compound. But it wasn't long before these plastic products demonstrated marked advantages. They resisted oil damage. Cracks didn't develop as readily to form paths for treacherous electrical shorts.

So it was natural for engineers and designers to turn to Auto-Lite when a problem developed in supplying nipples for high tension circuit connections on coils and distributor caps. And again performance reports give evidence of a better product.

Already other developments are crowding for consideration, products calling for bigger areas, more difficult shapes. Auto-Lite engineers are bending every effort to show what can be achieved with injection and compression molding of plastics and meeting with remarkable success. Should you have a plastic problem which needs solving their experience in this field may prove helpful to you.

THE ELECTRIC AUTO-LITE COMPANY
BAY CITY *Bay Manufacturing Division* MICHIGAN

BUY WAR BONDS

Specify
AUTO-LITE
PLASTICS
FOR THE DURATION... AND AFTER



Architect Marcel Breuer, now professor in Harvard's department of architecture, trained, then taught at the famed Bauhaus. To his credit are the first tubular steel chairs and some of the best examples of contemporary architecture and industrial design here and in Europe.

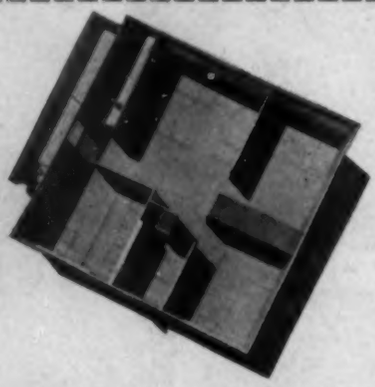
FROM WARTIME PLASTICS-BONDED PLYWOODS... THIS "PLAS-2-POINT HOUSE" FOR POSTWAR LIVING

HARVARD'S Marcel Breuer has pondered the skeleton of a modern bomber . . . probed the possibilities of war-born, new plastics-bonded plywoods . . . and produced this interesting and original design for postwar prefabrication which he has christened the "Plas-2-Point House."

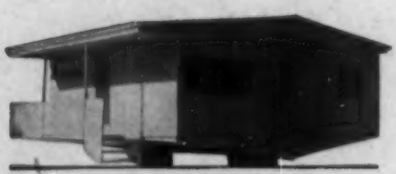
"Compared with current prefabricated construction," Mr. Breuer estimates, "the Plas-2-Point House would weigh a third as much, cost only 70% as much and, knocked down for shipment, would occupy only 30 to 40% as much packing space. Even fully assembled houses could be trucked short distances from central assembly lines to individual building sites, then quickly anchored to foundation blocks."

Since neither walls nor partitions are load-bearing, the "Plas-2-Point House" is highly flexible. Exterior wall panels might be heavily insulated for cold climates or simply a series of screens for the tropics. They might be built up from Resinox-bonded plywood with a durable, colorful, weather-resistant melamine surface—or even from paper or fabrics impregnated with Resinox and melamine resins.

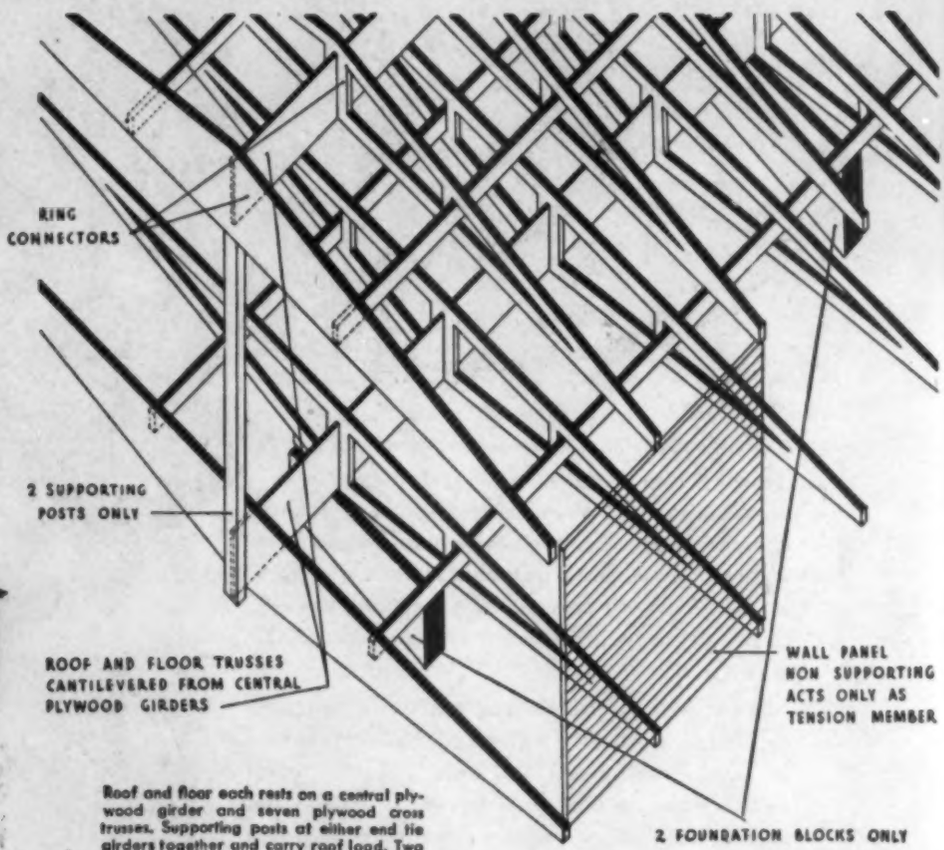
To save weight, gain production economies and add new notes of color and style, many of the house's fittings and accessories would probably be molded from plastics.



***Interior partitions** might be omitted, completed later. As family grows, a second complete unit might be added. Actually this house allows greater flexibility than conventional custom building.*



***With its narrow foundations, two-way** cantilevered form and plywood skin, "Plas-2-Point" house is reminiscent of modern aircraft. Six-room house for cold climate would weigh 3 to 4 tons.*



Roof and floor each rests on a central plywood girder and seven plywood cross trusses. Supporting posts at either end tie girders together and carry roof load. Two foundation blocks, four feet by eight inches, provide anchorage. Outside walls serve as tension members and give structure rigidity.

The Broad and Versatile Family of Monsanto Plastics

(Trade names designate Monsanto's exclusive formulations of these basic plastic materials)

LUSTRON (polystyrene) • **SAFLEX** (vinyl acetal) • **NITRON** (cellulose nitrate) • **FIBESTOS** (cellulose acetate) • **OPALON** (cast phenolic resin) **RESINOX** (phenolic compounds)

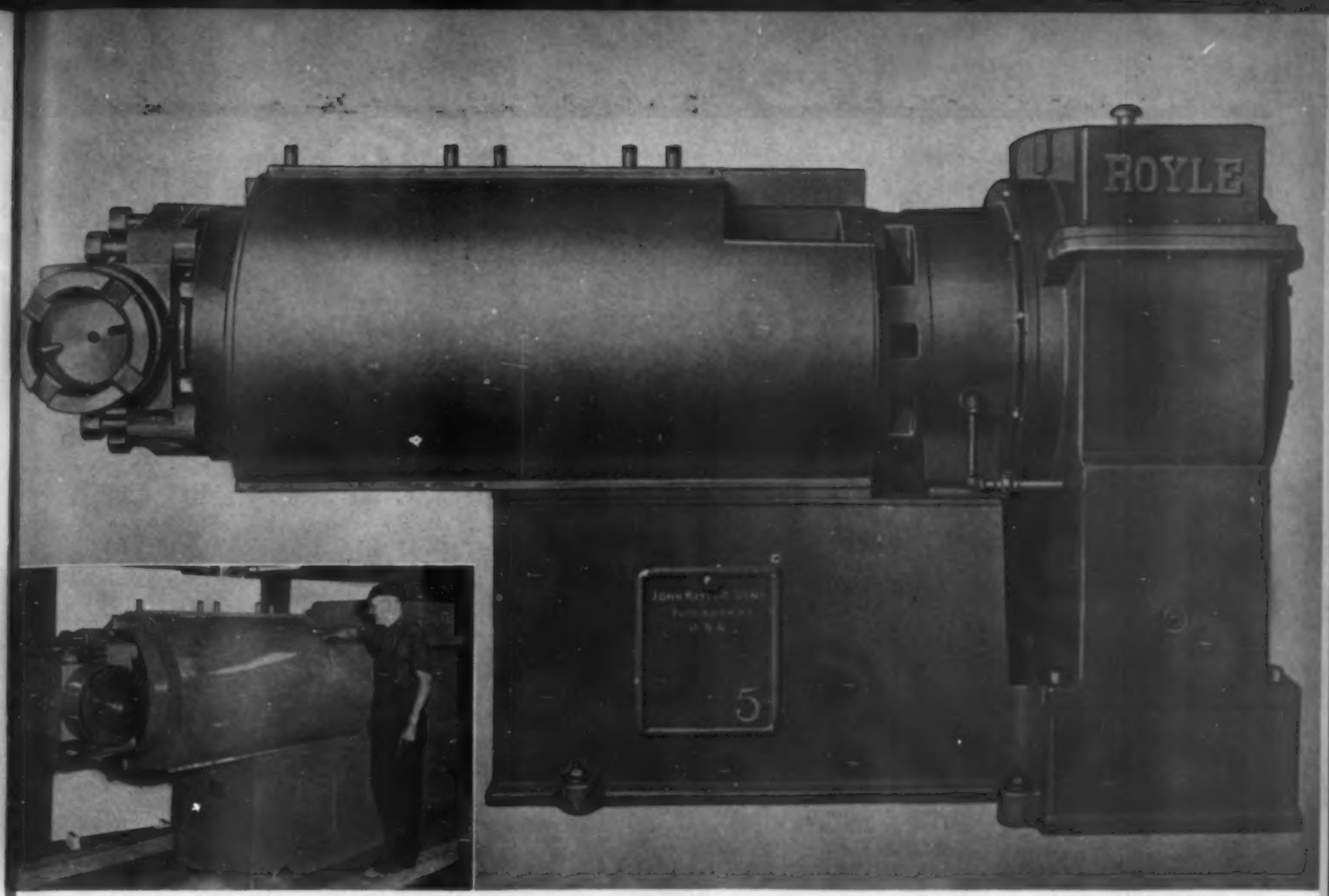
Sheets • Rods • Tubes • Molding Compounds • Castings • Vuepak Rigid Transparent Packaging Materials

MONSANTO PLASTICS

SERVING INDUSTRY...WHICH SERVES MANKIND

FOR FACTS ON POSTWAR PLASTICS...

For facts on postwar plastics and ideas on what they may be able to contribute to *your* particular products — see the 24-page booklet prepared for product designers, "The Family of Monsanto Plastics." There you will find information on significant new wartime advances in plastics materials and fabricating techniques, such as the new, rubber-like Saflex compounds, pulp molding and low-pressure bag molding. You will also find charts of comparative properties, graphs and photographs describing the complete family of Monsanto Plastics, probably the broadest, most versatile group of plastics offered by any one manufacturer. For your copy, simply write: MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield, Massachusetts.



VAST QUANTITIES OF PLASTIC MATERIALS ARE NOW EXTRUDED ON ROYLE MACHINES

Mastery of the technic of extrusion and wire covering, acquired by Royle's more than half a century of service to the rubber and plastics industries, is embodied in efficient —

ROYLE EXTRUDERS
FOR PLASTICS PRODUCTION

ARMY E NAVY

Let's Work and Fight for the Free America We Love

These sturdy machines are serving the nation in manifold kinds of war production.

They will be available for the expansion of the plastics industry when peace is re-established.

Royle plastics extruders are offered in a variety of types for the specific requirements of various plastics applications.

JOHN ROYLE & SONS

PATERSON 3, NEW JERSEY

BUILDERS OF A LINE OF GREAT EXTRUDERS FOR RUBBER AND PLASTICS

ROYLE PATERSON N.J.

AKRON, OHIO
Represented by J. C. CLINEFELTER
UNIVERSITY 3726

LONDON, ENG.
Represented by JAMES DAY
(MACHINERY) LTD.

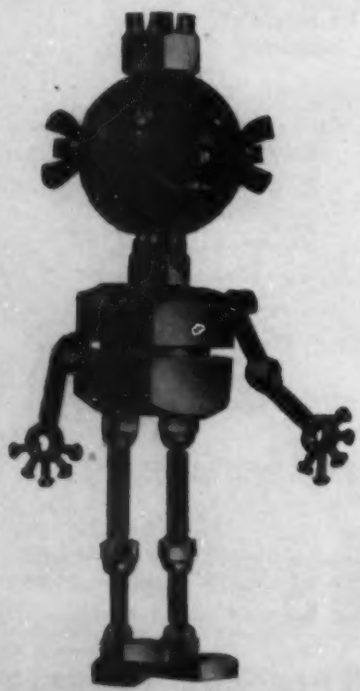


PERFORMANCE

is the proof of

GOOD FASTENERS





Use the NATIONAL QUALITY LINE... dependable fastening devices for industry for 54 years

Performance counts—and The National Screw & Manufacturing Company fastening devices have been making top-flight performance records in industry for 54 years.

From the tiniest screw, bolt, nut or rivet to the very largest, so complete and diverse is the National quality line, that we can supply or make most any size or type of fastening. Today, for instance, we are meeting exacting Army and Navy aircraft specifications on all sorts of headed and threaded products.

If you need fasteners—large or small—see us. Perhaps we can't supply you right now—but we can and will give you the full benefit of our years of experience.

National
HEADED AND THREADED
PRODUCTS

THE NATIONAL SCREW & MFG. CO., CLEVELAND, O.

MODERN PLASTICS

OCTOBER, 1943 VOLUME 21 NUMBER 2



PHOTO, COURTESY GOODYEAR RUBBER CO.

The Strato-Sentinel, one type of barrage balloon that today stands guard several thousand feet in the air, over our important military centers and vital war production plants

No blowouts for barrage balloons

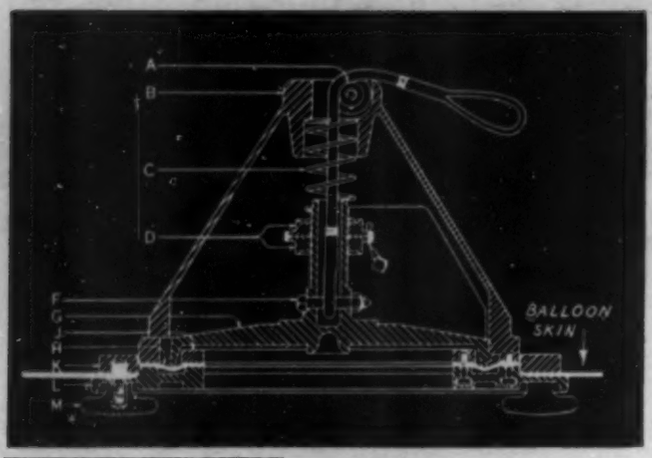
LIKE every rule "offense is the best defense" has its exception. The maxim breaker in this case is the barrage balloon. This craft now in the charge of the Coast Artillery Corps is at once the most nonaggressive and the most feared of weapons. Totally without armor and with no crew to fire at approaching planes, these balloons have earned the healthy respect of Axis pilots who usually leave them strictly alone and, instead, seek out targets that are not defended by these silent guardians.

These barrage balloons are lighter-than-air craft. Made of a delicate cotton cloth that has been rubberized, the standard low-altitude type is 68 ft. long. Buoyancy is supplied by the 12,000 cu. ft. of hydrogen with which each bag is inflated. The quantity of gas does not fully distend the balloons at the low level at which they usually are moored awaiting the siren's warning of impending attack. However, when these balloons are sent up into the air to stand guard several thousand feet in the air, atmospheric conditions cause the hydrogen to expand. The delicacy of the fabric is such that considerable gas expansion, due perhaps to the heat of the sun, would quickly rend a hole in the bag. So that the pressure of the hydrogen within the balloon may be kept within certain predetermined limits, a gas release valve is inserted in the outside wall through which measured amounts of hydrogen can be released into the outside air.

Until recently these release valves were made of aluminum —approximately 7 lb. of the metal going into each unit. In an effort to save this critical material, the entire assembly was redesigned to employ plastics with a consequent reduction of 25.7 percent in weight. Since these balloons are lighter-than-air craft with only the buoyancy of gas to assure ascent, structural weight has a marked effect upon the speed with which the barrage mounts guard over the target.

British experience has shown these sky sentries to be the best protection against surprise, one of the main problems in defense against attacking planes. Dive bombers have the unpleasant habit of hiding in cloud banks and swooping down from the sun without warning. Often eluding advance observation posts, they may drop their bombs before effective opposition in the form of anti-aircraft fire and fighter squadrons can be sent up. But barrage balloons are not easy to surprise. Present defense plans call for the bags to be floating over the targets within a few minutes after the call to battle stations. The use of lightweight plastics in the molding of the gas release valve parts promises to fractionally reduce this time. We may take added assurance that the balloons will be floating close to the target in case of an attack by enemy planes—waiting.

In reality it is not the balloon itself that offers protection. It is the cable connecting the bag with a winch on the ground



1

DRAWING, COURTESY GENERAL ELECTRIC CO

1—This blueprint of a barrage balloon gas valve shows the following 8 parts which are molded of plastic: A, pulley; B, housing; D, nut; G, diaphragm; J, inner securing ring; K, frame securing ring; L, frame; M, wingnut. Other parts of the valve indicated on this drawing are the spring C, the bolt F, seating H and balloon skin N

that is poison to a plane. These cables are capable of shearing off the wing of an attacking dive bomber that runs into them or of cutting the fuselage in half. Adding to the danger are certain lethal devices with which the cable is equipped. Except at night and in foggy weather when the attacker sees the balloon barrage too late to pull out of the dive, these connecting cables force enemy planes to a height where defending aircraft and anti-aircraft guns can best get at them. Also, by keeping the attackers to a high altitude, the balloons minimize the chances of a bomber registering a hit even if it weathers opposition fire. These gas-filled bags also serve as invaluable aides to aircraft listening posts by keeping planes high in the air where the range of sound-detecting apparatus is truer.

The gas release valve which protects the balloon bag from damage due to expansion of the hydrogen, is inserted into the outer wall of the fabric at the back of the balloon as shown in Fig. 2. The valve is actuated by a pull cord anchored to the diaphragm, a partition separating the gas chamber from the air compartment. When gas pressure increases, forcing down the diaphragm, the gas release pull cord is drawn downward, opening the valve. When pressure in the gas chamber decreases, the diaphragm moves upward causing the gas valve cord to become slack. The easing of the tension on the cord allows the metal spring in the valve to force the opening plate into its original leak-proof position.

The present valve assembly, measuring 8 in. in diameter by 1 ft. in height, involves the following 8 plastic parts which can be identified by letter in Figs. 1 and 3:

Housing (B), weighing 26.57 oz.
Frame (L), 12.82 oz.
Frame securing ring (K), 12.75 oz.
Diaphragm (G), 12.00 oz.
Inner securing ring (J), 3.02 oz.
Wingnut (M), .30 oz.
Pulley (A), .20 oz.
Nut (D), .69 oz.

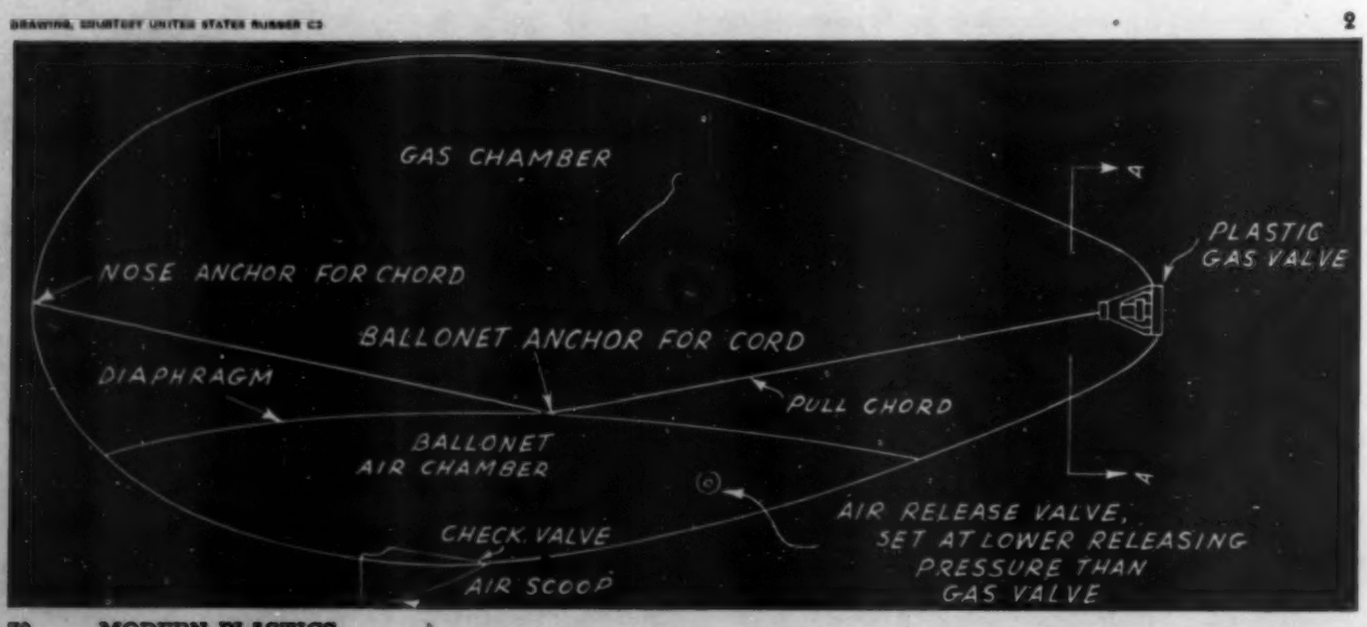
All 8 parts are compression molded of medium impact phenolic in single cavity molds with the exception of the wingnut which is produced in a 2-cavity die since 2 of these parts are needed in each assembly. Using a 17-in. press at a pressure of 2500 p.s.i., the large parts are molded in 10-min. cycles and the small pieces in 3-min. cycles.

As can be seen in Fig. 1, the balloon fabric is clamped between the frame (L) and the frame securing ring (K) by the wingnut (M). So that the release valve will be leak-proof except when open, the diaphragm (G) is seated on a rubber gasket (H) which in turn is held in position by bolting the inner securing ring (J) to the frame. The housing (B) also is attached by screws to the outer frame (L). To bolt these parts together in the manner indicated, 24 threaded metal

2—The location of the plastic gas valve is clearly indicated in this cross section of a typical barrage balloon. It is the pull cord, attached to the diaphragm, which activates the valve. When expansion of gas in the gas chamber forces down the diaphragm, the pull cord opens the valve. When contraction of the gas in the chamber causes the air in the ballonet to force the diaphragm upward, pressure on the pull cord is relieved and the release valve closes. The other end of the cord is anchored to the nose of the balloon

DRAWING, COURTESY UNITED STATES RUBBER CO

2



inserts are required on the inner securing ring (J), 8 on the outer securing ring (K) and 30 in the housing. In the molding job the inserts for the inner and outer securing rings are driven onto pins while the 30 housing inserts are loaded on the top half of the mold by a drive fit. Since all inserts must fit accurately so that connecting screws will register with the holes made in the frame to accommodate them, the molding operation requires the greatest precision. Eventually is it planned to change the design of the entire gas release valve so as to eliminate all but 6 inserts while doing away with the inner securing ring.

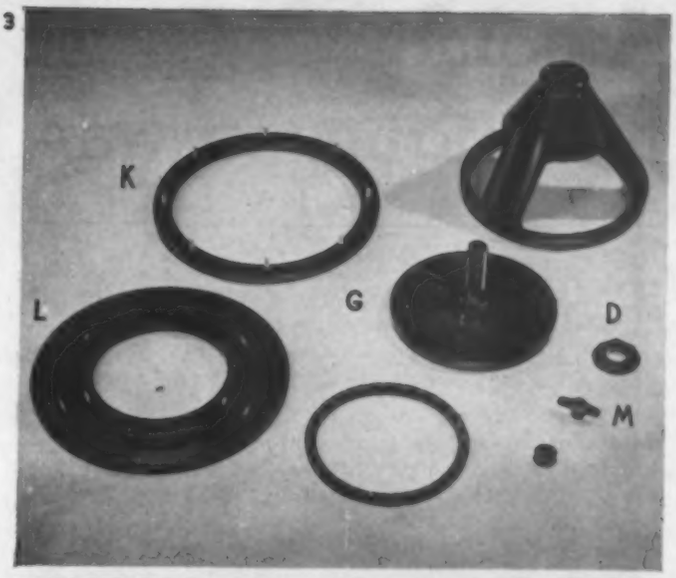
In the original British gas valve, retaining wires were attached to the diaphragm (G) to prevent this closing plate from twisting out of position. The American design substitutes ribs on the top surface of the diaphragm for the more cumbersome guy wires. Some holding device is necessary since the off-center position of the pulley tends to impart a spiral movement to the diaphragm. Figure 4 shows the manner in which the triangular cross bars on the diaphragm correspond to the sloping ribs of the housing which serve as guides during the opening and closing of the valve.

In the final assembly of the entire valve which requires about one hour (Fig. 4 and 5), 2 bolts (D in Fig. 1) are used to clamp the pull cord to the diaphragm. This cord which is threaded through the center of the actuating spring (C) passes over the small molded pulley assembled in the top of the valve housing with a laminated plastic pin. Very little finishing is required on the 8 molded phenolic parts except for removal of burrs, buffing of the edges, cleaning and retapping of the inserts.

Failure to raise the usual barrage of balloons in one London area during a recent daylight vengeance raid resulted in 6 Nazi planes getting through the city's defense. A school lost 48 killed, mostly children. The explanation was that the lighter-than-air crafts were down because of maintenance work being done upon them. Despite the quantity of barrage balloons being turned out in the United States, it is important that every one of them be ready for instant service. All of them are necessary whether they are of the "low altitude" type that fly at a height of several thousand feet and are used to protect permanent installations, or of the "very low altitude" species that go only half as high and can be employed as a mobile barrage attached to landing barges, trains or tanks. If their delicate casings can be protected from operational damage, hours of repair time will be saved and another step will have been taken to keep our sky sentries on constant guard.

Credits—Material: Textolite. Molded by General Electric Co., Plastics Dept., for United States Rubber Co.

3



4



5



3—The 8 plastic parts which comprise the barrage balloon gas release valve are shown here, marked according to the lettering mentioned in Fig. 1. The 2 wingnuts (M) required in each assembly are compression molded in a 2-cavity die. The other 7 parts are compression molded of medium impact phenolic in single cavity molds. As can be seen, 24 threaded metal inserts are required on the inner securing ring (J), 8 on the outer securing ring (K) and 30 in the housing (B). 4—This view of the final assembly of the release valve shows the ribbing of the plastic housing which serves as a guide for the diaphragm. 5—It is the flat, bottom surface of the gas valve which protrudes through the balloon envelope

Automotive techniques in war

THE automobile industry, for most Americans, symbolizes all-out conversion to war production. As such, it conveys a picture of the sound and fury of metal working and machining; of long assembly lines rolling out tanks and airplanes, guns and jeeps, where formerly the latest de luxe convertibles were born. This is a true picture—but it is not complete.

Today plastic products play as important a part in the implements of war as they did in the pleasure cars of peace time, and important automotive plastic molding plants were among the first to be converted 100 percent to war. In a few short months the urgencies of war have carried automotive plastic techniques years ahead. Examples of plastics molding problems that have been quickly conquered and quietly incorporated in the routine of war production promise much for futuring automobile manufacturing.

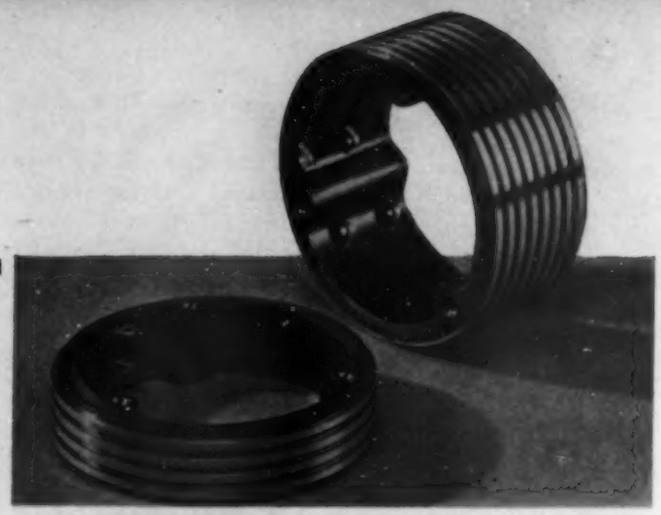
Typical of these wartime trail blazers is a Midwest plastics molding plant, which today is 100 percent engaged on war products—and busier than ever before. This company's plastics engineers were among the first to produce a successful rubber substitute of injection molded resins. Their rubber-like grommets, bumpers, door jambs and pads of many sizes and shapes are used today in nearly every American machine of war. Millions of these parts are being turned out yearly by a fast, automatic production technique. In addition the plant is mass-producing compression, injection, extrusion and transfer molded pieces to some of the toughest specifications ever thrust upon a plastics manufacturer. Included on the list are such items as bomb and shell noses, aircraft instrument cases, shell firing pins, airplane dash assemblies, gyro-compass and automatic pilot parts, distributor caps and many other parts for tank and airplane engines.

Also of importance are parts made from sheet stock. In this category are the various types of instruction, diagram and statistical panels used in the aircraft, vehicle, electrical and machinery fields. Research items include a plastic tubular rivet which already has replaced metal in some applications and threatens to become a serious competitor of the metal rivet in many types of construction. The plant appears to be particularly successful in the molding of intricate electrical and electronic parts requiring the precise placing of many metal inserts. Here are case histories of a few of the most interesting items:

Collector ring for automatic pilot

The automatic pilot or "Iron Mike," one of the real secrets of the Army Air Forces' precision bombing, is a wizardly device designed to keep a plane flying in a fixed direction at a predetermined altitude. It is the most sensitive and complex instrument in use on bombing planes—an intricate combination of gyroscopic, electrical, electronic and hydraulic instruments, more complex even than the famed bombsight with which it is closely linked in operation. In contrast to usual "tough" tolerances of .003 to .0003 in., the automatic pilot has many parts on which no deviation whatever from absolute perfection is permitted. The 2 main

1



2



3



4



PHOTOS NO. 2 AND 3, COURTESY ELECTRIC AUTO-LITE CO

1—Two compression molded phenolic collector rings, one with 4 and the other with 8 rings. 2—Disassembly of a collector die used for molding a 4-ring unit. 3—The phenolic material goes into the preheated mold in tablet form. 4—A 7-in. switch block for an automatic pilot

gyroscopic units require 2184 precision parts. As the minutest particle of lint or dust would destroy the accuracy of the instrument, much of the assembly work is done under glass; work rooms are air-filtered; floors are vacuum-swept; special lint-free smocks are worn by employees; and all parts are kept under cellophane or koroseal covers when not in use.

Impulses registered by the gyro units as the plane seeks to deviate from its predetermined flight path and altitude are picked up by delicate electrical contacts, amplified and fed to the actuating control mechanisms. It is in these electrical contacts that such parts as the collector ring play a vital part.

One of the toughest jobs attempted by this plant, the collector ring (Fig. 1) is compression molded of phenolic material, with from 4 to 8 rings of nickel silver molded into its outer circumference. Since these rings which provide a delicate electrical contact must be precisely placed, there arises the troublesome problem of expansion and contraction. This difficulty was first attacked by selecting a plastic material with a coefficient of expansion as near as possible to that of the metal. Further relief was given by slotting the rings, much as piston rings are cut, to allow some compression without cracking the plastic.

Assembly of the die cavity is an exacting job because of the necessity of placing the rings precisely. An idea of the problems involved in the molding of the piece may be gained from Fig. 2 which shows disassembly of the die used for the 4-ring size. A single cavity mold is used, with duplicate dies, so that while one piece is being molded and cured the second die is being disassembled and reassembled for the next piece. The phenolic material goes into the preheated mold in tablet form (Fig. 3), and curing time is 3 min. although the actual total cycle is 5 min.

Switch blocks for automatic pilot

Because of the large number of metal inserts involved, the molding of the switch block for an automatic pilot presented another difficult problem. Some of the 7-in. square switch blocks, looking like miniature switchboards (Fig. 4), have as many as 42 brass inserts. The blocks are usually compression molded of phenolic material. The problem of heating and cooling the part in use has been solved by close attention to the coefficients of expansion of the plastic and metal materials used.

Distributor cap for tank engines

Typical of the many difficult parts requiring special dielectric properties and high impact strength is this distributor head which contains 7 holes and 7 brass inserts molded into the piece (Fig. 5). The part is molded in a hand mold. The phenolic material used for the part was developed initially for extrusion molding around resistors. A single-cavity die is used. As in the case of the collector ring the technique is to employ 2 molds—one being disassembled and reassembled while the other is curing. The curing time is 4 min., and the complete molding cycle is $9\frac{1}{4}$ minutes. The olive-colored distributor cap is complete as it comes from the press except for the drilling out of a center hole. The metal inserts for this part—in fact most of the other molding inserts used in the plant—are manufactured on the premises from bar stock.

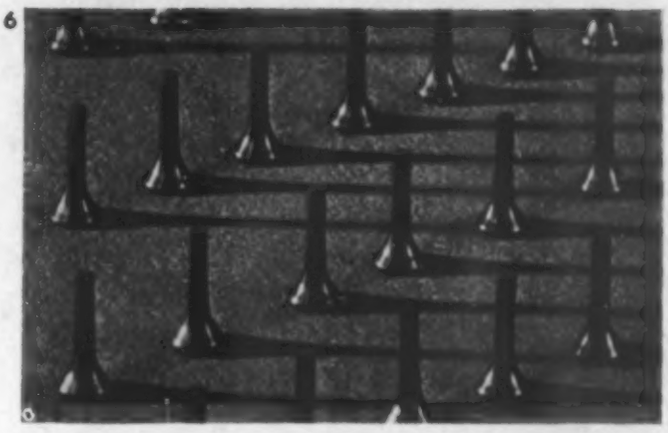
Shell firing pins

It would be difficult to think of a piece of armament more important than the tiny nose firing pin which actually sets

5



6



7



8



PHOTOS NO. 7 AND 8 COURTESY AUTO-LITE CO.

5—Phenolic material is used in the molding of this distributor head which contains 7 holes and 7 brass inserts. 6—Over a million nose firing pins are turned out each day. 7—Pins are compression molded in a 30-cavity mold. 8—Completed pins as they come from the mold



9



10

9—These 4-in. rings of vinyl material are used as vibration dampers on gas tanks and radiator fill pipes. A few of the smaller, various-sized grommets can be seen at the top. 10—This aircraft instrument board is compression molded of a black phenolic cotton-flock-filled compound. All the lettering on this shiny board is hand-filled

off the explosive charge in many of the shells being hurled at the enemy by America's land and naval artillery. Yet with the finding of the proper plastic material and the perfection of a rapid automatic molding technique, these vital firing pins (Fig. 6) are being turned out at the rate of a million or more a day with virtually no manual attention.

To replace critical brass, material for these pins had to be extremely hard—of extremely high impact strength. The black phenolic thermosetting material selected for this application shows a tensile strength of 8500 lb. p.s.i. and an impact strength as follows:

Energy to break	0.16 ft. lb.
Per in. of notch	.32 ft. lb.
Per in. square	2.00 ft. lb.

The molding compound is simply fed into the hopper of an automatic machine, and the pins are compression molded in a 30-cavity mold which is in continuous automatic operation requiring no further attention (Fig. 7). The molding cycle is 85 seconds. Completed pins (Fig. 8) drop from the machine into a bin. After tumbling to knock off the flash and cutting to exact length, they are ready for shipment to shell-loading plants.

Vibration damper

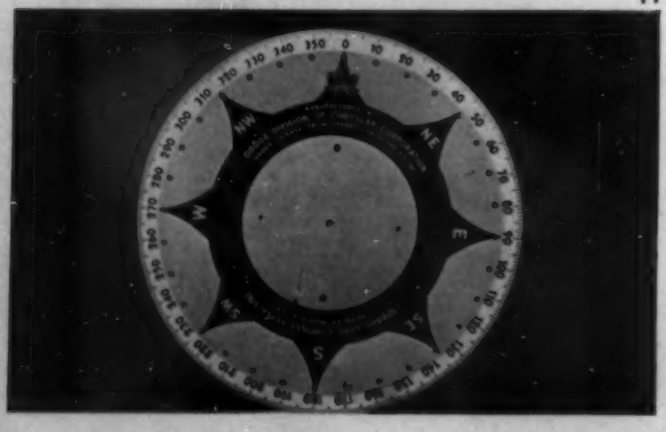
From the molding of smaller, rubber-like grommets for a multitude of uses in planes, tanks and vehicles, this plant has progressed to large 4-in. rings of the same vinyl material, which are used as vibration dampers on gas tanks and radiator fill pipes (Fig. 9). Grommets first were produced here as a rubber substitute using ethyl cellulose, but the vinyl material has proved much superior. Parts of this type are injection molded in multiple cavity dies on injection machines which operate at a high rate of speed. While some of the smaller grommets are arranged 10 to the die, the larger dampers are molded in a 4-cavity die with extreme simplicity characterizing the operation. When the material is unloaded from the die, the sprues are simply snipped off and thrown back in the hopper for reuse.

With the 8-cavity mold used for the smaller, various-sized grommets, company engineers have perfected an ingenious setup which permits the manufacture, through use of a single mold, of between 550 and 600 different types and sizes of grommets. This operation is accomplished by shifting plates and pins in the die setup. Not only can the diameters of the 8 grommets produced in the mold be adjusted, but also their thicknesses. In addition, either square or rounded edges can be produced. These dies unload 3 times per min. and after the removal of the sprue, the grommets or dampers are immediately ready for shipment. In contrast, rubber parts previously in use required 10 to 15 min. of curing time. Because of this manufacturing advantage, it is expected that plastic will permanently replace rubber in this type of vibration damper.

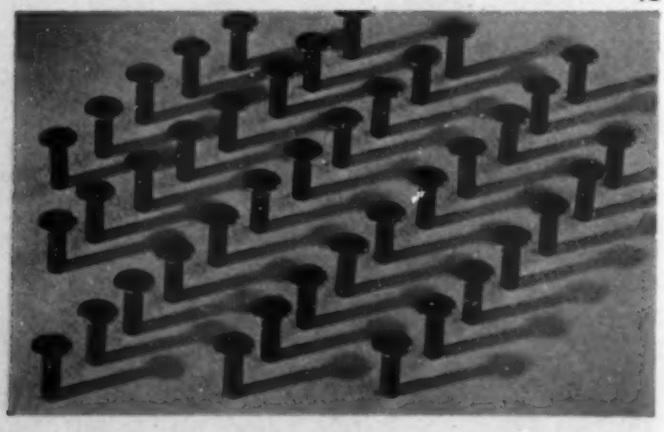
(Please turn to page 150)

11—Extreme accuracy is required in marking and calibrating the repeater dial for a gyro-compass. The translucency of the plastic outer rim permits light to shine through and simplifies reading of the markings. 12—These tubular plastic rivets are used in bookbinding. Under heat and pressure the open ends spread and turn back

11

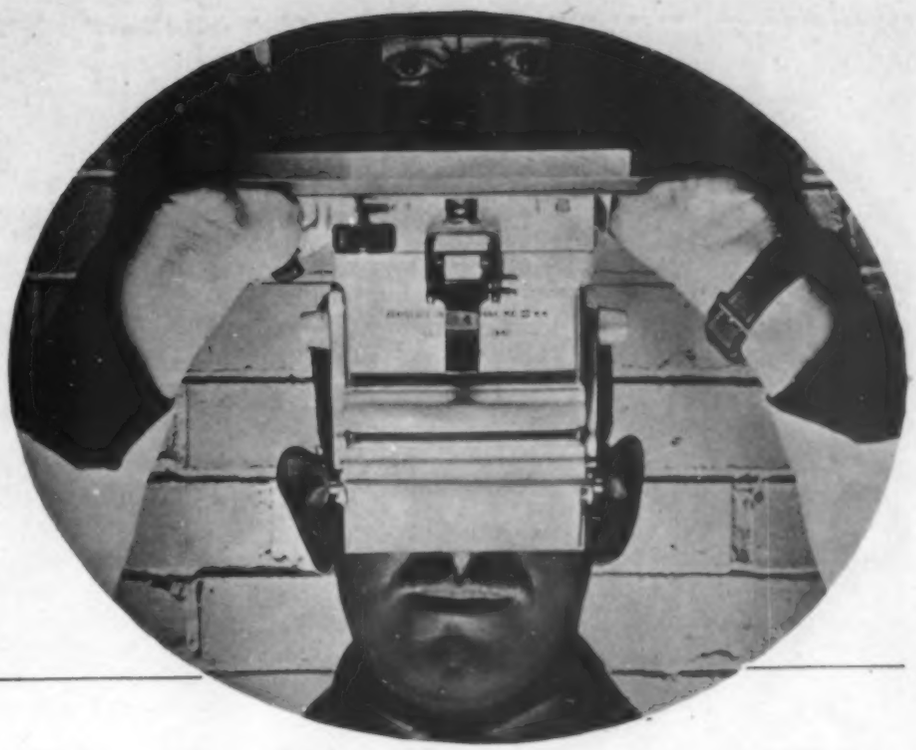


12



"Eyes" of the tank

When a direct hit is made on tank periscopes, these plastic lens holders make it possible for the unit to be back in action in a matter of seconds



LIFT yourself figuratively out of that chair for the moment. Transport yourself to Sicily, Tunisia or Kharkov. You are behind the controls of a 32-ton caterpillared land dreadnaught moving through a barrage of shellfire, trundling over rocks, trees and barriers with the tank crew of the United Nations. This is no victory parade on Main Street. You are down in the bowels of the tank taking your direction by radio and watching the terrain in front of you through a tank periscope—the eyes of the modern tank.

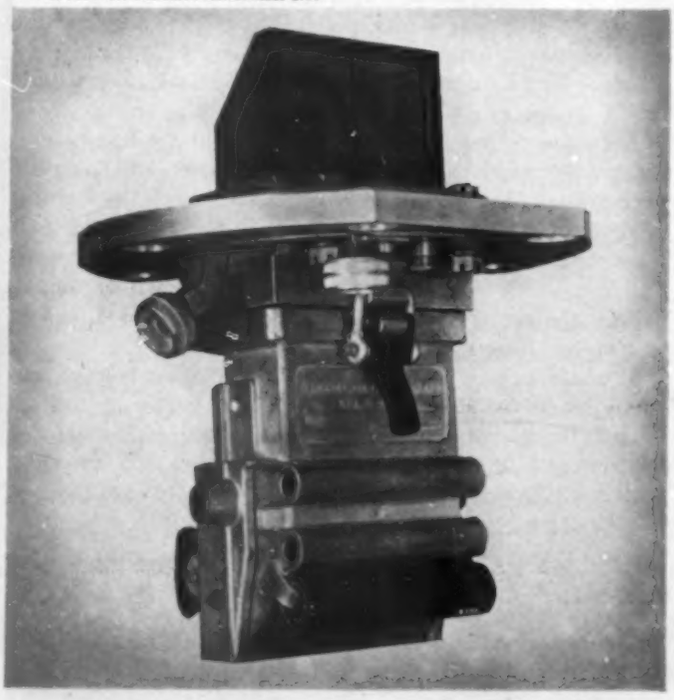
Through the smoke and shell splinters a machine gunner plants one right in the middle of your "tank eyes." Suddenly you aren't seeing at all. In a matter of seconds, while the gunner or the tank commander assumes the task of guiding you over the blind spot with his periscope, you wrest the shattered holder from your own periscope and push a new lens holder into position. Your "eyesight" is restored.

When you lose your "eyes" in a tank blitz it is just as routine as that. No lost motion. No dropping out of the attack. The three extra lens holders shipped with each periscope that is assembled and installed, keep you in the action.

The spare part which came to your rescue so efficiently is the new plastic lens holder designed by Research Enterprises Ltd. of Toronto, Canada, makers of tank periscopes and other scientific fighting equipment. Founded in August of 1940 under the management of Col. W. E. Phillips, this company is wholly owned by the government and operates under the Canadian Minister of Munitions. A shortage of binoculars in Canada at the outbreak of the war started a chain of events which eventually led to the starting of company operations on September 3, 1940. The two original employees soon were being assisted by a small group of glass experts from Great Britain, loaned to help the new company through its initial production. While organized to supply Canadian war industries with optical glass, lens and prisms, Research Enterprises Ltd. now produce a variety of optical instruments chiefly fire-control instruments such as gun sights, dial sights, periscopes and other military requirements hitherto imported into Canada.

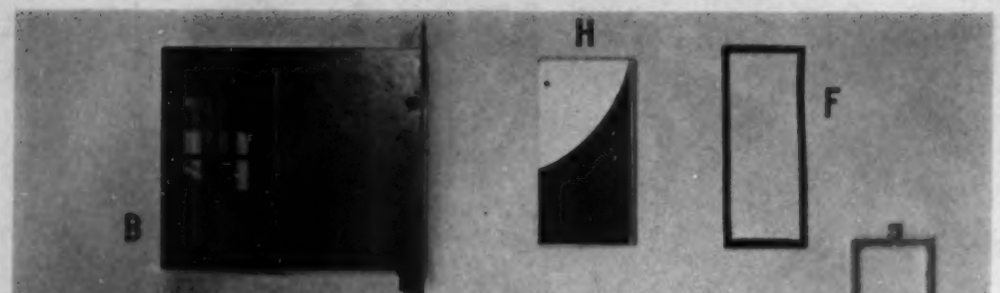
When the company accepted the contract for the production of tank periscopes for Canadian-built Ram and Valentine tanks as well as for armored cars, the design was based on a periscope of British origin which was constructed of materials obviously in short supply and, in some cases, of materials too costly to employ in Canadian production. A kindred problem was a shortage of skilled labor, machine equipment,

PHOTOS, COURTESY RESEARCH ENTERPRISES LTD.



2

2—In this final assembly view of the periscope which is used in Canadian-built Ram and Valentine tanks as well as in armored cars, the phenolic lens holder may be seen mounted at the top. On the basis of peak production, the plastic holders are estimated to have saved 792,000 man-hours annually and 79,200 lb. of aluminum



3

3—The component parts of the phenolic lens holder are the housing (B), molded inserts (C), front window (D), base window (E) and various assembly parts. A rear view of the housing is shown at A. 4—The recess to take the front window represents an undercut and necessitates a special mold design. The lens holder at the left is up-ended to show the bottom opening and the brackets to which a metal rim is attached



4

ALL PHOTOS, COURTESY RESEARCH ENTERPRISES LTD.

tools and dies. Under the direction of Chief Mechanical Engineer E. W. Bartle, the engineering department set about redesigning the periscope in line with existing materials and labor facilities. This meant substituting by redesign practically every part of the original periscope. Die-cast zinc was used to replace elaborately machined gun-metal, a precious war-time alloy consisting of 88 percent copper, 10 percent tin and 2 percent zinc. Experiments with plastic materials resulted in the use of molded phenolic parts to take the place of many aluminum parts. Front-surfaced mirrors were designed to substitute for costlier prism glass.

When the experiments were finished, this company had a tank periscope which could be produced at lower costs and with savings in materials, manpower and machine tools. In terms of taxpayer's dollars the new design meant a total saving of almost a million and a half dollars—yet at the same time produced a periscope capable of withstanding combat conditions perhaps more efficiently than the precisely machined earlier model which was suggested for duplication in Canada. A fully assembled unit is pictured in Fig. 2, with the plastic lens holder mounted in place at the top of the periscope.

Use of phenolic resin had a big share in the savings as well as in improving the flexibility of the prism holder—a part of the periscope which is of first consideration in combat. In experimenting with available metals in connection with the redesign of the periscope, it was found that casual bullet or shell fire landing on or in the vicinity of the periscope frequently twisted or expanded the metal as a result of the impact. The replaceable part, containing the lens or prism, often jammed in the metal framework designed to hold the 2 sections of the periscope. Under these conditions the tank crew, without any serious damage to their armour or cannon, might be obliged to operate with reduced vision, and under hazards likely to increase tank casualties. On the other hand, when struck directly, the plastic-bound prism or lens was found to shatter sufficiently to allow rapid replacement of the upper lens without jagged metal parts jamming the periscope. With 4 observation points on each tank, this was an important consideration.

When the engineering department decided to employ the molded plastic lens holder, the first step was to experiment with plastic materials to secure a high impact material. They were seeking a material which would withstand shock against shell splinters, jamming of parts, corrosion from engine fumes, sand storm and other exigencies. Experiments with different materials were carried out under actual combat conditions. Engineers shock-tested the lens holders of different components with drop hammer tests, with rifle bullets, and finally with 6 lb. cannon using flat head armour-piercing shells. The latter tests were made on artillery ranges under military supervision, attended by United Kingdom Inspection Board Officials.

The component parts that make up the lens holder when fully assembled may be seen in Fig. 3. This illustration shows the back (A) and front (B) of the lens holder, molded inserts to hold the mirrored glass in position (C), the front window (D), the base window (E) and assembly parts: gasket (F), retaining metal rim (G) and screw parts (H).

In redesigning the lens holder and in processing it from phenolic resin, the economy of employing front-surfaced mirrored glass reflectors in place of prism glass required a carefully organized study of the type of mold and particular attention to water absorption within the holder. Prism

glass provided solid reinforcement with a minimum of open areas where moisture could collect within the plastic holder. The use of plain mirrored glass created greater possibilities of water absorption. It was necessary, therefore, to give special attention to the design of the mold and to the water sealing operations on the assembly line. As soon as the design was completed and satisfactorily tested, the company was able to subcontract the entire production and assembly of the holders.

The plastic housings are molded in 2-cavity transfer molds using a high-impact, rag-filled phenolic material formulated especially for this application. The mold is set up semi-mechanically. The recess to take the front window, which can be seen at the right in Fig. 4, represents an under-cut necessitating a special mold design. The wedges for securing the mirror in position are compression molded from an all-purpose phenolic material. Three brass inserts are molded into the wedges to receive the retaining screws.

The assembly of the unit commences with the sealing of the front window to the molded-in recess in the housing. An asphalt base cement is used as a seam filler to provide a waterproof bond between the glass and the plastic recess. The next operation inserts the front surface aluminum mirror into place with the two wedges. Holes are drilled and tapped from the outside. When the retaining screws have been installed they are counter-sunk and waterproofed.

The base glass is then placed in position and a special wax is run hot around the edges to waterproof the glass to the side walls. The bottom opening in the lens holder and screw holes used to attach the metal frame to the housing are shown at the left in Fig. 4. A special gasket is fitted over the base glass, and the metal retaining rim is installed with screws to secure a compact assembly. Two screws on each side are penetrated to the retaining rim to strengthen the assembly. The unit finally is cleaned and ready for inspection tests.

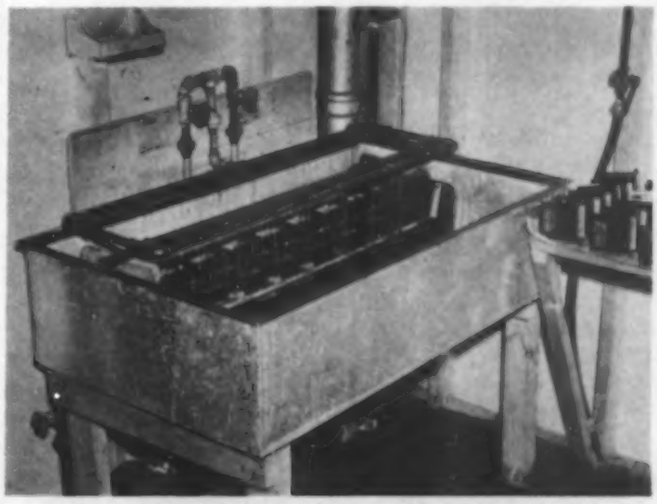
Inspection is detailed and entails a number of tests. The first test is for cleanliness of the glass windows and mirror. Rigid optical tests then are made to check for deviation and distortion (Fig. 6). Water spray tests, shown in Fig. 5, prove the units against faulty sealing and susceptibility to water absorption. In all there are 3 of these water tests lasting for a period of one hour each with a one-hour drying out period between tests. A percentage of the units are also given a heat test to check the efficiency of the sealing compounds. Vibration tests are made to guarantee proper assembly. These tests duplicate shock and vibration conditions which prevail in the periscope when it is installed in a combat tank. The 3 extra "eyes," which are shipped as replacement parts for each periscope assembled and installed on the Ram Tank, are provided at reduced costs and are confidently regarded by military authorities as an improvement over previous designs.

The molded phenolic holder on the basis of peak production was estimated to have saved 792,000 man-hours annually, released for other production 133 machine tools and substituted 29,700 lb. of plastic material for 79,200 lb. of aluminum alloy. The plastic design also made it practical to use plain mirror reflectors in place of costlier prism glass—a total net saving on the contract production costs of approximately $755,855.

This contribution of the plastics industry toward greater operating efficiency in tank warfare emphasizes the strides which post-war production will take when the peace has been signed. That the plastics horizon in Canadian industrial production is steadily widening is borne out by this and other notable achievements by Canada's war industries.

Credits—Material: Durite. Lens housing molded and assembled by Duplate of Canada Ltd., for use on tank and armored car periscopes manufactured by Research Enterprises Ltd.

5



6



7



5—After assembly each lens holder is given 3 water tests each lasting for one hour with a one-hour drying out period between trials. Water is sprayed over the completed housings to test them for faulty sealings and susceptibility to water absorption. 6—Here the holders undergo rigid examination to guard against deviation and distortion. 7—The lens holders are being given a final optical test prior to shipment and installation

PRODUCT



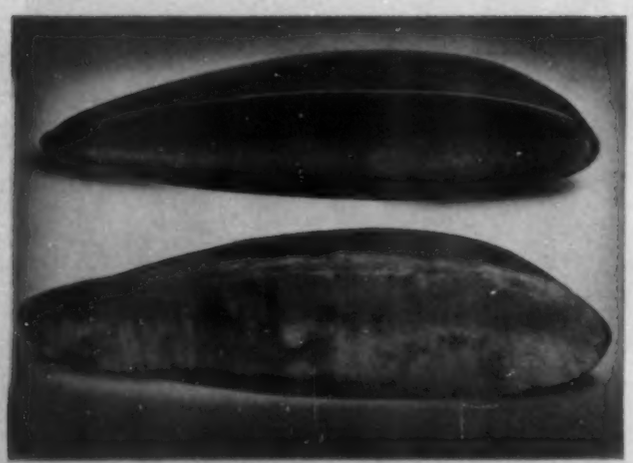


Hand-held microphones

Wherever our soldiers go there must be dependable communications. Modern warfare centers around instantaneous and unfailing transmission of messages, whether under the boiling tropical sun or in the frigid Arctic.

One such instrument which has seen successful service with our armed forces throughout the world is this T-17 hand microphone molded of phenolic material. The microphone, produced by one of the pioneers in its conversion from aluminum, is assembled from the following 6 plastic parts: case (A), cover (B), button cap (C), button base (D), clamping base (E) and handle cover (F). To provide the proper strength and uniform density, the case is transfer molded of black canvas-filled phenolic, a 2-cavity mold being used. Two removable plugs are used in these body molds to produce the hollow core of the handle. Both the cover and the button cap are compression molded in 8-cavity dies of black cotton-flock phenolic. The 3 remaining parts also are compression molded; the button base of black cotton-flock phenolic in a 12-cavity mold, the clamping base of natural canvas-filled phenolic in a 9-cavity die and the handle cover of black canvas-filled phenolic in a 4-cavity mold.

Credits—Molded by Chicago Molded Products Corp. for Shure Brothers





Supplementary gas

Naval planes must fly far and fast. Both requirements demand tremendous quantities of gasoline. Since long overseas hops and running dogfights allow for no time-outs or stopovers for the refilling of depleted tanks, allowance must be made before take-off for emergency supplies of this vital fuel. For all such cases jettison tanks offer a solution. When used to augment the fuel supply for the delivery of planes, they can be detached at the receiving station and returned to the original point of departure. Carried in battle flight these tanks furnish the gasoline to power the plane for the early stages of the dogfight and then are dropped.

The phenolic sisal from which this jettison tank is molded offers the advantages of light weight, easy formability and resistance to abrasion. The tank first is formed in 2 halves by the bag molding method. Before these half shells are riveted together at the flanges with a gasket giving a more perfect seal, baffle plates are installed inside the tanks to prevent excessive sloshing of the gasoline. These baffles also are molded of phenolic sisal but by the hydraulic hot press method. In a final operation the jettison tanks are painted. While the thin gauge metal tanks do not withstand abrasion, these plastic jettison tanks will stand up under considerable impact as from flying stones.

Credits—Material: Co-Ro-Lite. Molded by Columbian Rope Co. for the U. S. Naval Air Corps

DEVELOPMENT

Lightweight hinge

Airmen tend to look on heavy metal fittings with a jaundiced eye. To them every ounce of excess weight on their plane means a few less bombs dropped on enemy targets during a particular flight. But piano-type hinges of cellulose acetate recently adopted by a major aircraft producer for use on tool boxes, oil immersion boxes, radio, map and chart cases do more than meet the demand for light weight. Their strength makes them suitable for articles of relatively heavy construction.

These hinges, extruded in continuous lengths, are available in sizes up to 6 ft. although other lengths may be obtained on special order. With a tensile strength of 110 lb. per lineal inch and a sheer strength of 85 lb. per lineal inch, the fittings have a working temperature range from 65° to 165°. Available in ivory or any other requested color the hinge is operated by a .091 in. oil-tempered spring steel pin and may be attached by screws as shown at the right, or by hollow rivets, bonding agents, Bostich metal stitching and staples. In use they have been found to withstand long hard wear without denting, chipping or cracking and to be rust-proof and dirt-resistant.

Credits—Material: Tenite. Manufactured by Plastic Process Co. for Douglas Aircraft Co.



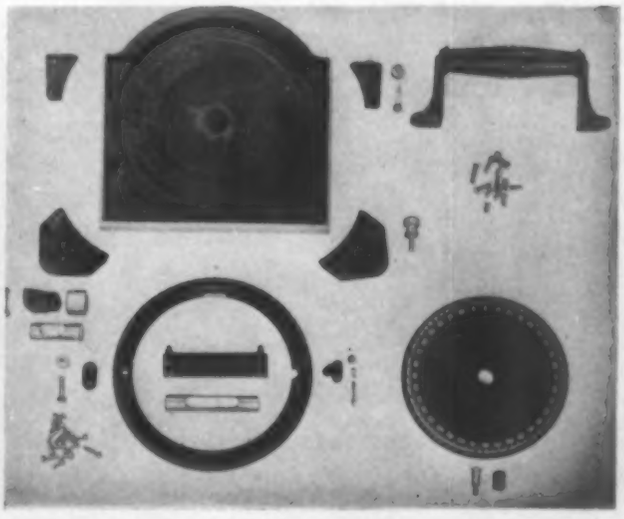


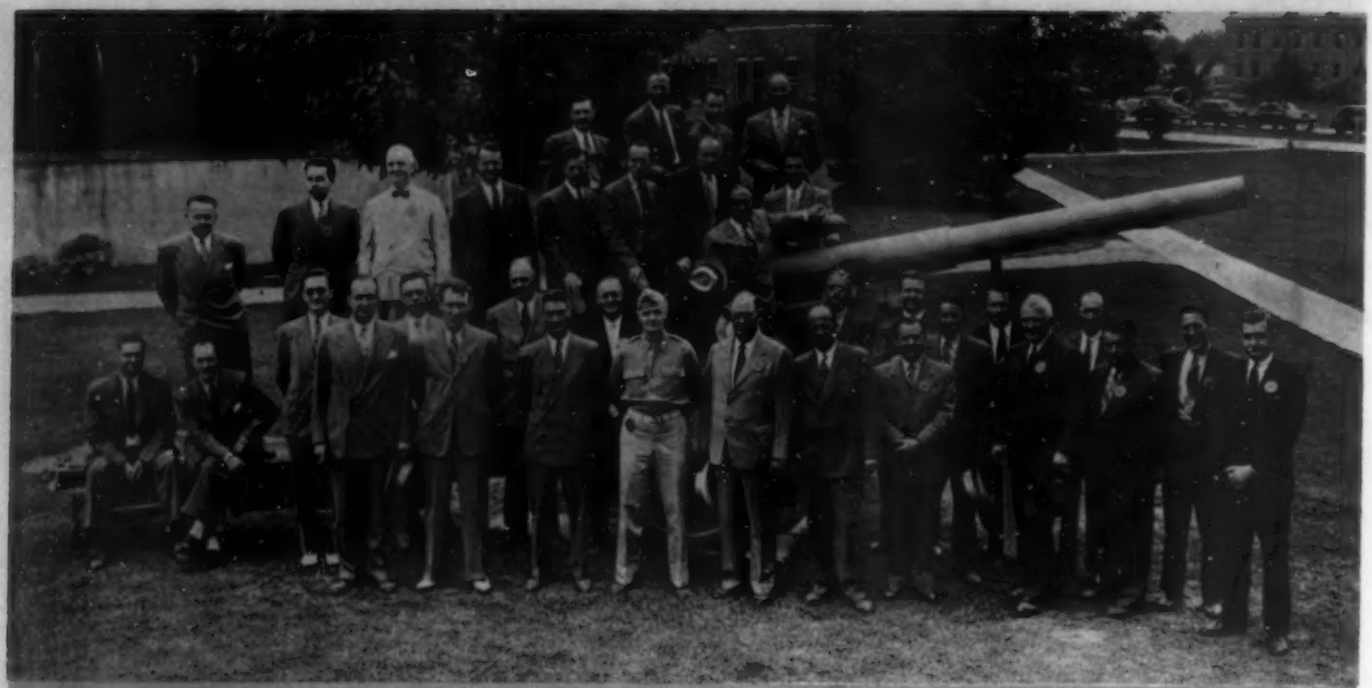
A propeller protractor

In addition to the human ground crew that swarms over our fighting planes at the end of every mission, numerous precision instruments go into action. One device contributing to the long life and efficient performance of our airplanes is the propeller protractor used in adjusting the blades of a propeller to perfect alignment and pitch. Unless each blade is set at the exact angle in relation to the hub as are its fellows on that propeller or on other propellers of the same plane, a terrific strain is thrown not only upon the motor but on the entire plane structure. Since blade variations appear from time to time no matter how carefully the propellers are set at the factory, a constant check must be made to detect the error before serious trouble developes.

The intricate instrument used to check this alignment now is being made of plastics. After extensive tests for accuracy and wear under all weather conditions, ethyl cellulose was selected for the molding of the 9 main protractor parts. These pieces including the base, cogwheel, vernier, handle, bracket, bearings and pivot are molded in 6 dies with one cavity for each part. Meeting the Army requirement for tolerances no greater than 3 one-thousandths of an inch, this instrument only employs metal as a band around 3 sides of the base and for various screws.

Credits—Material: Lumarith. Molded by Cruver Mfg. Co. for Army Air Force





BEHIND THE SCENES

LONG before Pearl Harbor, leading members of the plastics industry were laboring to develop and convert military equipment parts to plastic materials. Metal-saving conversions were affected, numerous parts were improved, and production was greatly increased in many instances, all through the use of the proper plastic. This great showing would not have been possible without full and complete cooperation between the War Department and the many plastic molding companies that assisted in this work. To further this unity of purpose, industry groups have been invited from time to time, to visit military centers so that they might see their materials in actual use.

In pursuance of this policy, Lt. Col. Henry Erwin of U. S. Army Ordnance decided that the two technical committees of S.P.I. should be given an opportunity to inspect at first hand the results of their efforts. Through the cooperation of Major Edward McBride, the 50 members of these two committees (Fig. 1) were taken on a complete tour of the Aberdeen Proving Grounds on August 26. It was Major McBride, plastic expert of Army Ordnance, who was instrumental in instigating many of the studies which developed into production jobs. The M-52 fuse is an outstanding example of plastic molding not only in the Ordnance Department but also in the history of plastics.

The Aberdeen tour covered the automotive section in which every item on wheels or treads is tested. From this point the group was transported in tanks and other military vehicles to the aircraft section. On this latter range (known as the main front) all types of large anti-aircraft guns are proof-fired and either passed for combat action or rejected for return to the manufacturer. Moving to the seacoast section, the group was shown large coast defense rifles and testing sites on which not only Army coast artillery but large Naval rifles are proof-fired. The 50 visitors then were treated to a demonstration of the fire power of practically every small firearm now in use by our forces. This equipment included the old standard Springfield and the new Garand, various carbines, machine guns and submachine guns. Each member of the group was permitted to test his skill by firing several shots from the standard Springfield, the Garand and a carbine. Having riddled the targets, the S.P.I. members proceeded to the section of the Proving Ground at which armor plate is checked. They were shown the enclosed ranges and the technical equipment which is used for this purpose.

The tour then moved to the Engineering Building which contains all types of captured enemy matériel ranging from the smallest rifle bullet to the largest enemy tanks, half-track personnel carriers and anti-aircraft equipment. The most outstanding German plastic ap- (*Please turn to page 150*)

PHOTO, COURTESY U.S. ARMY ORDNANCE



2

1—Members of the two technical committees of S.P.I. who visited the Aberdeen Proving Grounds are here grouped around Major McBride and George Scribner, president of S.P.I. 2—The grips of this Italian 9-mm automatic pistol are molded from plastic—probably phenol-formaldehyde

Resin-bonded plywood tubing

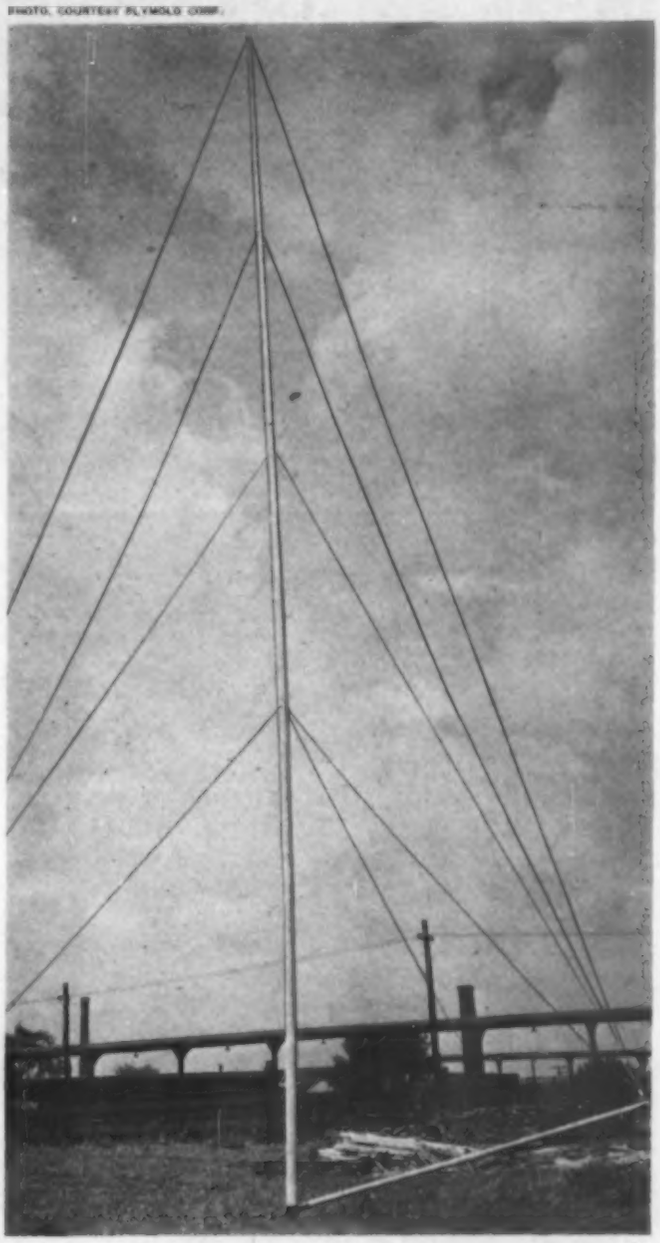
TELESCOPING masts 90 feet high, diminutive trouble light covers for airplanes, practice bombs and telescope carrying cases—of such diverse character are the articles being made from a recently developed wood veneer, spirally or longitudinally wound and bonded with urea-formaldehyde resins. In instances where this tubing, product of a Massachusetts manufacturer, has been used for aircraft purposes, Army-Navy aircraft specification AN-G8 has been met satisfactorily. Prior to adoption this tubing was field-tested by the Army for 10 months.

According to one of the company's executives, the management knew nothing about veneers when work was started a little over a year ago. Two important facts soon became apparent—first, that there is a great difference in the properties of the various species of wood, and second, that the manner in which the veneer is cut from the tree has an influence upon the final application. Experience proved to the company that one veneer was especially good in a tube where gasoline was used because the fibers of this hard wood were so closely knit together that the resultant tubing was what this management calls "gasoline proof." In this same connection, the manufacturer found that birch, maple, poplar, fir and gum were easiest to work while for all-round military purposes so-called aircraft grade veneer was most suitable. Results of intensive experimentation showed that each thickness of veneer is best adapted to the forming of tubes of a particular diameter or strength requirement.

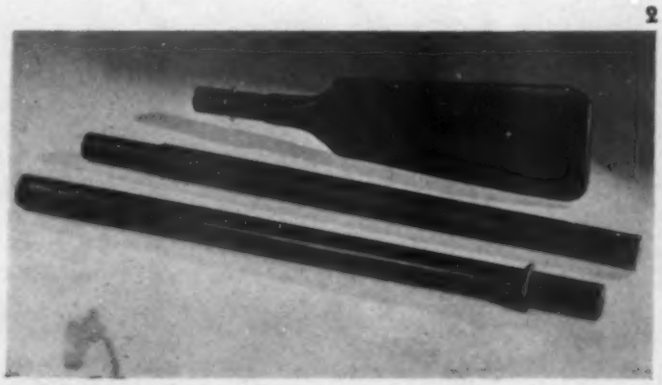
As regards the plastic resins, the company found that for all-round purposes the thermosetting resins were more satisfactory although seemingly more difficult to use. After selecting urea and phenol as the best bonding agents, plant executives decided upon the use of the less critical urea-formaldehyde resins although their tests showed that urea would not stand up to boiling water as well as phenol. However, the manufacturing process evolved can be used with either type of resin.

After a special process of resin impregnation, thin layers of wood veneer are wrapped spirally on a mandrel, in such a manner that in some cases the veneers are parallel to the axis of the tube and in other cases they are + and − 45° to the axis. By use of this 3-phase construction for which a patent application is pending, the tube is said to approximate

PHOTO, COURTESY PLYMOLD CORP.



1



2

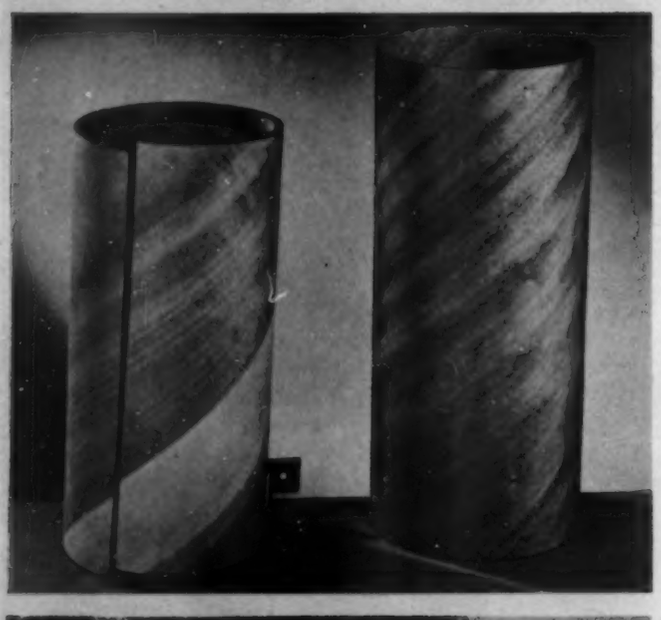


3

1—This 90 ft. telescoping mast weighs approximately 200 lb. complete with fittings. For shipment it nests in 3 bundles, and it can be erected by one man in an hour. 2—This light blue oar is made in 3 sections for use with aircraft life rafts. 3—In the center is the body of a practice bomb designed to hold a cartridge and to be used with a heavy metal nose. The trouble light covers (right and left) are assembled from a cap and a nose



4



5



6

PHOTO, COURTESY PLYWOOD CORP.

the fiber stress of the plain wood parallel to the grain. It is claimed, however, that in the tube this strength is maintained in all directions. In short, the tubing is said to approximate the ultimate strength of wood. This contention would seem to be borne out by tests conducted at the Harvard Graduate School of Engineering. A section of an early experimental report submitted by Prof. R. Von Mises of that school states: "From the foregoing results it may be concluded that a very promising way to construct wooden tubes has been found. The mechanical properties of the plywood tubes are such that they will doubtlessly constitute a useful structural element if a process can be developed that leads to accurate and uniform production. Also, it seems that the combination of spirals with a longitudinal grain yields almost the full strength of wood. Further improvements may therefore be expected only within narrow limits."

Since the compilation of this report, dated January 13, 1943, the company has developed an automatic machine that will turn out the tubing in endless lengths—tubing that is bonded and in a final thermoset condition. While details of the operation of this machine cannot be divulged pending the granting of a patent, the company and its customers in the Army and Navy feel that it has solved the problem of accurate and uniform production which was mentioned in the foregoing statement.

After the veneers have been wrapped on a mandrel the tubing is bonded under heat and pressure. Relatively low pressures are exerted, and the cycle of cure is stated to be less than 30 minutes. As its program becomes perfected, this firm expects to utilize high-frequency heating.

The veneer laminates run from 2 to 35 plies. At present, the tubing is manufactured with inside diameters from $\frac{1}{2}$ to 18 in., in wall thickness from .05 to .50 in. and in any reasonable length. Tubes also have been made with $\frac{1}{4}$ and 24-in. outside diameters. Tolerances on comparatively small tubes maintain the I.D. to −0 in. and +.010 in. Wall thickness is within + or − .005 inch. Currently, production is at the rate of 5000 ft. per day, but the company expects to increase this figure through plant expansion and the granting of licenses. Results of tests on the small diameter tubing show the following specifications:

Ultimate compressive strength, p.s.i.	11,500
Young's modulus for axial compression, p.s.i.	1,400,000
Compressive proportionality limit, p.s.i.	6,000
Young's modulus from buckling failure (Euler's formula), p.s.i.	1,400,000
Ultimate tensile strength, p.s.i.	11,000
Young's modulus for axial expansion, p.s.i.	1,700,000
Tensional proportionality limit, p.s.i.	6,000
Young's modulus for deflection, p.s.i.	1,500,000
Specific weight, depending upon specie of veneer and method of construction	.75

The strength to weight characteristics of this plywood tubing make it suitable as a replacement for critical war materials wherever weight is a factor. An example of this application is the radio telescoping (*Please turn to page 142*)

4—This plywood tubing telescope carrying case is designed to replace a leather container now used by Army Ordnance. 5—At left is a fire extinguisher bottle support—a split tube with a reinforcing ring at the base. The outside clip is for the de-icer line. The tube at right is an oil reservoir. 6—Rigidity is an important advantage of this tripod used to support Army equipment

Night into day

by E. F. LOUGEE*

Shedding its light in all directions, this portable fluorescent extension lamp has an important function to perform in illuminating interior installations in modern planes



PHOTO, COURTESY DOUGLAS AIRCRAFT CO., INC.

LIGHT is as essential to war production as materials or time. Daylight is best, of course, but for a good part of the year, daylight works only a 12-hour shift. Some months in certain sections of the country provide 14 or 15 hours of daylight, but war production goes on around the clock. Workmen, therefore, must have artificial light when daylight fades. Many plants are so constructed that very little daylight seeps in at any time of year. Furthermore, daylight is a total stranger in the hold of a ship, in the wing or deep in the fusilage of an airplane, or inside a self-sealing bullet-proof gasoline tank where workmen and workwomen do much of their most painstaking work and inspection.

Fluorescent lighting is the closest artificial approach to daylight. It is commonly used in engineering and drafting departments, general offices and over production lines. I say "over" because fluorescent fixtures usually are suspended from ceilings in banks or rows of multiple units to flood the surrounding areas with brilliant light. Through the development of a portable fluorescent extension lamp by Day-Ray Products, this same brilliant illumination now may be carried into the darkest corners of a construction job. It brings daylight to working areas that were difficult if not impossible to reach with any other type of portable extension. Its slender tube-like shape is only $1\frac{1}{2}$ in. in diameter and requires no protecting cage to interfere with light distribution.

The reason the light needs no protecting cage is because the fixture is made of plastics—not glass. The cylindrical shield is transparent acrylic, $\frac{1}{8}$ in. thick. There are 5 molded parts besides the tubular shield. To withstand shocks, these pieces are injection molded from hard flow acetate butyrate. They are bright transparent red so that the extension lamp can be quickly spotted on the floor in the path of a hurrying truck and not be crushed. The molded parts (Fig. 2) include top and bottom caps threaded to screw tightly into either end of the transparent tube. The top cap supports a folding hook which when opened may be used to suspend the lamp by simply hooking it over a wire, pipe, or in the lapel or buttonhole of a workman's jacket or shirt. Then there are top and bottom sockets which hold the fluorescent tube and supply current to the light. These parts also hold tiny connectors and springs, and provide a place to plug in the conventional starter such lamps require. The bottom socket is molded in 2 parts and assembled with screws.

Neoprene gaskets and cord seals are used to make the fixture water-tight. One gasket is placed between the acrylic tube and the bottom cap, another at the top between the tube and cap. Where (*Please turn to page 144*)

* Plastics Institute.

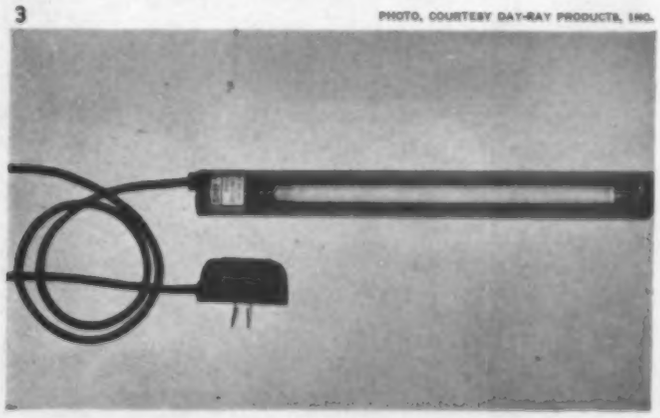
2—The lamp assembly includes a cylindrical shield which can be seen in the background, 5 parts injection molded from transparent red acetate butyrate, and 2 small gaskets (shown in the lower right foreground). 3—The fluorescent light weighs but 8 ounces, not including the cord and ballast

2



3

PHOTO, COURTESY DAY-RAY PRODUCTS, INC.



PLASTICS IN REVIEW



1

2



3

1 The amount of winter snowfall determines the ground's moisture content in spring. With a metal scarcity threatening the U. S. Weather Bureau's supply of snow tubes, upon which accurate snow measurement depends, this 24-in. length of transparent $1^3/_4$-in. Fibestos tubing was adopted in many observatories. Engraved on one side in $^1/_4$-in. gradations and fitted with a standard cutting head, the Fibestos snow tube was found to have such advantages as light weight with ample strength, smoothness of bore which permits easy emptying, a very low coefficient of expansion, freedom from danger of placing moist hands on frosty metal, and transparency

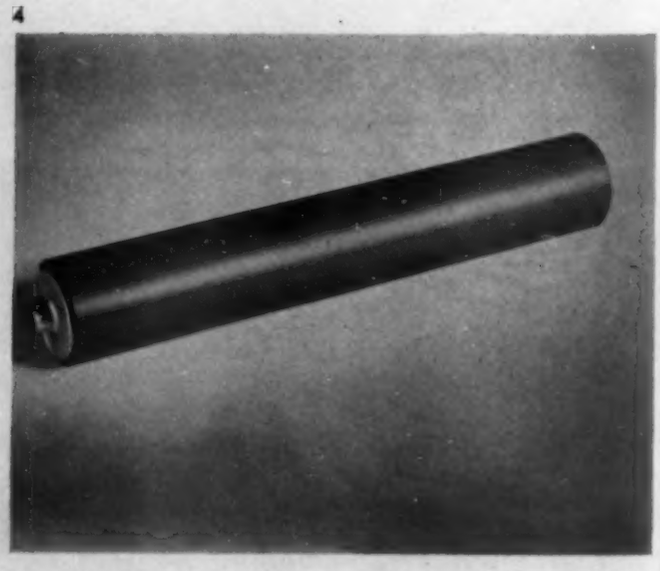
2 Cows no longer need be content with lumps of salt thrown down in a corner of the meadow. This Bakelite urea Roto container, $5^1/_2$ in. in diameter, has a central plug $1^3/_4$ in. deep which holds a salt stick while holes punched in the bottom allow the cows' saliva to drip out. Molded by Universal Plastics Corp. in 2-cavity molds on a 110-ton press in a $3^1/_2$-min. cycle, the container requires no finishing but the punching of holes and the filing of the edges of the bowl

3 Installed on the outside of Army training planes and gliders to operate the gyro in the bank and turn instruments, these Venturi tubes molded of Lumarith by Cruver Manufacturing Co., are a redesign of a metal tube keeping the same over-all dimensions. Required to meet critical performance specifications while withstanding every extreme of temperature and weather, these plastic tubes have proved themselves more uniform than metal Venturis, which tended to vary in wall thickness. Molding-in of the name plate, with consequent elimination of a riveting operation, did away with undesired air turbulence. Two of these plastic tubes, of different size, are shown in the accompanying illustration

4 With the manufacture of typewriters sharply curtailed, need for replacement parts grows apace as business offices try to keep up with production schedules. To meet the need for approximately 750,000 typewriter platens to keep old machines in working order, Koroseal has taken the place of rubber in platens for ordinary typewriters and in power roll covers for electromatic typewriters. In tests of original writing, wear, paper feed, embossing and manifolding, Koroseal platens have proved themselves satisfactory from the standpoint of performance and wear

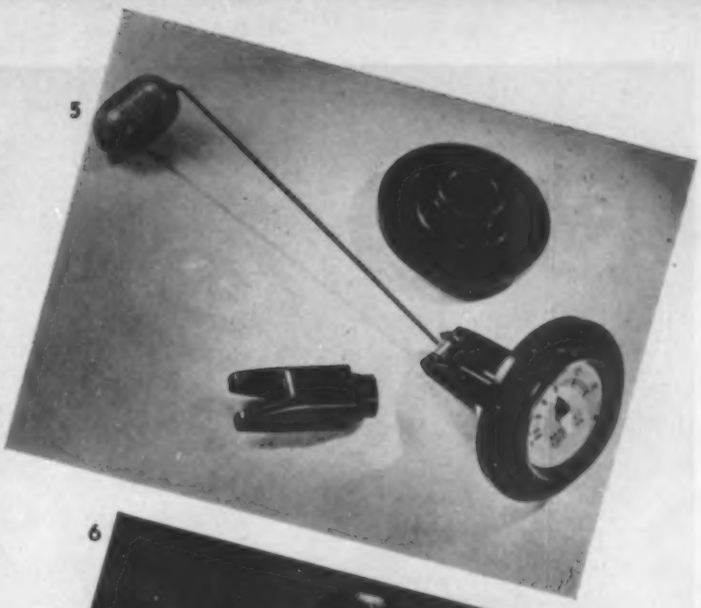
5 Long distance airplane flight pilots must watch the gas tank far more closely than any earth-bound A-card holder. This neat, compact Textolite gage helps them keep an eye on the con-

4



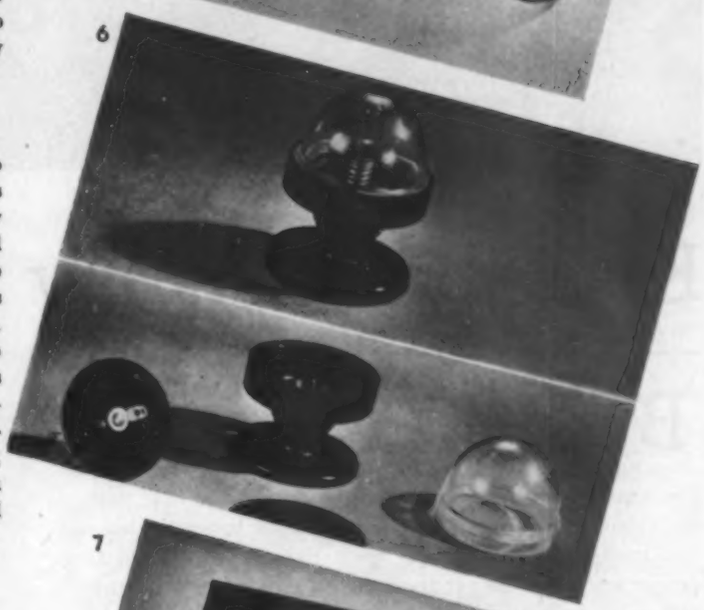
tents of the auxiliary fuel tank. The 2 plastic parts shown with the gage, molded of cotton-flock-filled phenolic by General Electric Co.'s Plastics Dept., are the body (top) and the head (below). Both are produced in 2-cavity molds, and threads are molded-in. Assembly and design of this airplane gasoline gage are by Boston Auto Gage Co.

5



6 "Gibson Girl" is the name bestowed for obvious reasons upon an emergency radio transmitter produced by Bendix Aviation, Ltd., and having an all-plastic housed signal light accessory. Black Tenite II is used both for back plate and housing of the light, each molded by American Molding Co. in 2-cavity molds. The original molds were developed by the "T" Die Cast Molded Products. Threaded portion of the housing is formed by loose cores while the outside shape is achieved by splits in the mold. The transparent globe, with integral threads molded-in so that it will fit snugly into the housing, is of polystyrene, molded by Plastic Die and Cast Products Corp.

6



7 When Allied soldiers hole in on some advanced battle line to await further orders, their man-borne, 2-way communications equipment is plugged into this $12^{3}/_{8} \times 11^{1}/_{2} \times 3^{1}/_{8}$-in. battery case. Molded of black Durez, modified impact, cotton-flock-filled material on a 475-ton press, the box cures for about $4^{1}/_{2}$ min. due to the thick ribs that run up on the inside of the piece, and then is cooled on a shrink form. In addition to 11 insert holes of $^{1}/_{4}$-in. diameter and $^{1}/_{32}$-in. depth which hold the cover to the box, a side hole and 2 bottom holes are molded into the box. The cover is molded of the same material on a 350-ton press. Finishing operations include the trimming of the case and the drilling of 10 sidewall holes which are used for electrical connections. The case, molded by Plastimold, Inc., for Emerson Radio and Phonograph Co., is seeing service round the globe. At times it has been used as a container for spare parts and repair tools.

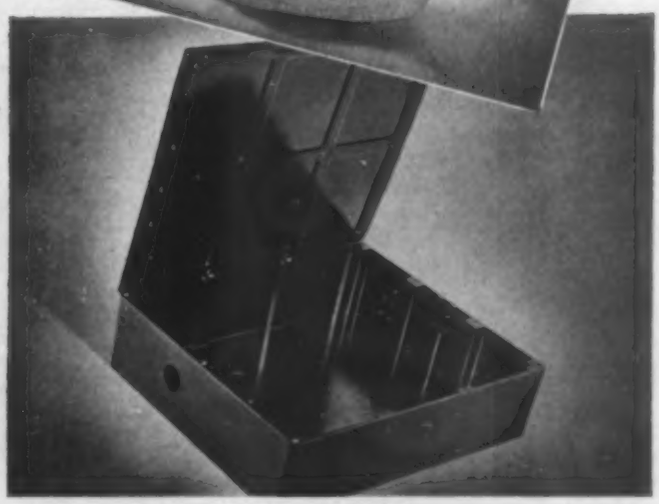
7



8 Adrift in a lifeboat with rescue hours or days away, seamen must hoard their limited supply of fresh water. So that not a drop will be wasted and to assure each man his just share, the Coast Guard has adopted this transparent Catalin polystyrene ration cup which is about $^{1}/_{2}$ in. in diameter and is calibrated in half ounces. Lowered into the water tank by a light chain threaded through holes in the lip, this tubular cup is automatically tipped on its side by a small, weighted ball attached to the rim of the cup to allow the entrance of water. Replacing opaque, metal vessels, whose use made exact division of supplies impractical this plastic cup is molded in a 2-cavity die by Maurice A. Lichten, Inc.

8







1

1—This blueprint shows the front, side and back of the new plastic insignia. At the lower right are two drawings of the spring steel fastener

Fasteners for Army insignia

"BUTTON, button, who's got the button" may be all very well as a parlor game, but when pursued during dressing such a hunt is wasteful of both time and temper. Consequently, when it was decided during the first part of 1943 that Army insignia be made of plastic instead of heavier and more critical material, much thought was given to a proper fastener. As yet these plastic pins have not gone into full-scale production.

The design of the new plastic insignia was made to include .045-in. diameter zinc-plated steel pins molded into the back of the emblem. However, with these pins as the bases for catches it was necessary to have an additional part which would securely fasten the insignia to the uniform and at the same time provide for their quick and easy removal. In its urgent need the Quartermaster Corp. enlisted the aid of Tinnerman Products, Inc., to advise as to the fastener best suited for the purpose.

A clip-type locknut made of spring steel was developed and put under test. After several modifications the unit was approved by the Quartermaster Corp. A drawing of this catch is shown in Fig. 1 together with a sketch of the new plastic Army insignia with the pins molded-in. As can be seen in the drawing, the base of the clip has a hole punched in its center to permit passage of the steel pin of the insignia. Another eliptical hole is made in that section of the single-wing prong which is bent parallel to the base of the catch. This latter opening is so placed that it is not quite concentric with the lower hole, leaving a space too small for the passage of the insignia pin. The double-wings of the prong that form the opposite half of the fastener are divided by a wedge-shaped opening which permits passage of the single-wing prong and also leaves an opening for the insertion of the fastening pin of the Army insignia.

2—The new clip that holds this plastic insignia in place is so designed as to preclude accidental removal



2

To apply or detach the nut it is merely necessary to place the thumb on the single wing, the index and second fingers on the 2 opposite wings, and pinch the 2 sides together. As a result of this pressure the 2 holes in the fastener are brought into line, and the catch can easily be slipped on and off the steel insignia pin. When finger pressure is released, the openings in the nut no longer are concentric, the fastener again firmly clips the stud, and the possibility of accidental removal is eliminated.

Each of the steel-plated prongs molded into the plastic insignia has one notch. This undercut is designed to give a still more secure bite on the speednut clutch and further insure against any sliding action. These parts are all parkerized with the addition of a zinc chromate primer since this is the type of finish approved by both the Army Air Force and the Bureau of Aeronautics.

The development of this speednut fastener has made possible the successful use of plastics and aircraft spring material in place of copper-base alloy materials which are of a more critical nature.

Credits—Material: Aircraft spring steel. Manufactured by Tinnerman Products, Inc.

Soap's role in the plastics industry

by GEORGIA LEFFINGWELL*

THE already rapid development of modern plastics has received a further stimulus from war replacement needs and stringent quality requirements. To help meet those needs, plastics chemists and technicians are combing the storehouse of industrial techniques and materials. This current research and practical experimentation is giving common soap a diversity of newer applications, particularly in the dispersion technique, so that soap now may be said to play a not-insignificant rôle in the war efforts of the plastics industry.

The plastics field encompasses a great variety of polymeric and high molecular weight substances, yet the versatility of soap has enabled its use in practically every branch. The cheapness and reliable constancy of composition of this chemical make it especially appropriate for the present and postwar large-scale production of plastics products.

One of the most successful applications to the field of synthetic polymers is in emulsion polymerization. Resins and rubber-like materials are produced by this method by emulsifying the monomer or co-monomers in soapy water, with or without catalysts, and permitting polymerization to take place. The product comes out as a dispersion in water, which makes for great ease of handling and control. An additional advantage of this method is that the polymerization rate is usually greatly speeded and a more uniform product obtained. While the Buna rubbers are not strictly plastics, it is pertinent to point out that approximately 100,000,000 lb. of soap will annually be consumed by American synthetic rubber industries once they are in full swing.

Plastics chemists are using this tool of emulsion polymerization more and more frequently. It is reported[1] that Japan prepares a styrene resin by this method, using an emulsion of styrene (1 part) in water (4 parts), 30 percent hydrogen peroxide (0.03 part) and soap (0.025 part).

An additional reason for emulsion polymerization is that resin dispersions are finding an increasingly large number of uses. The porous goods industries—textiles, leather, paper—are finding that plastics dispersions can be applied with little change in equipment, often without the use of heat (which might damage synthetic cloths or dyes), that they can produce very even coatings of all degrees of imperviousness and can penetrate the fibers readily to give adherent finishes. The paint industry has undergone a virtual revolution, the climax of which must be postponed for the end of the war and priorities, for the final development of the practical water-base dispersion resin paints. At present, these solvent and labor-saving paints are being reserved for war jobs—camouflaging gun emplacements and protecting military buildings and war plants. The shoe industry is grasping eagerly at the new resin emulsion rubber latex extenders which are finding use in leather cements and paper impregnation materials. These, and still other large industries, are using suspensions of plastics in water, often stabilized or prepared by means of soap, in ever-increasing quantities.

Examining these dispersions from a rather technical viewpoint, it is interesting and valuable to note the method of preparing them. A large proportion consist simply of the resin in water and soap, with or without modifying chemicals and colloidal stabilizers. A number of methods call for solution of the plastic in an organic solvent and then dispersion of this mixture in soap and water. A British patent[2] describes an aqueous glyptal paint where the resin is dissolved in a solvent, such as naphtha, and emulsified in soap water by means of a colloid mill. The paint is said to be flexible, abrasion-resistant, hard and able to withstand weathering to a superior degree. Flatting agents, pigments, plasticizers, driers and acid also may be added.

A similar type of suspension for lacquer[3] consists of a solution of an appropriate cellulose derivative (such as cellulose nitrate, cellulose acetate and the ethyl and benzyl ethers) in a water-insoluble, organic, slow-volatile solvent (butanol, butyl acetate, etc.). This solution is emulsified in an aqueous solution of soap, a softening agent (camphor, tricresyl phosphate) and a water-soluble organic film-forming substance, such as polyvinyl alcohol, a urea-formaldehyde resin, methyl cellulose and the like.

An interesting variant on this method is proposed in a recent patent[4] which is recommended for polyisobutylene, natural or synthetic rubber, polyvinyl compounds and cellulose derivatives. The polymer is dissolved in a water-insoluble volatile organic solvent (chlorbenzene, xylene), and the whole emulsified in water containing soap (sodium oleate) plus a small amount of a water-soluble organic liquid which is a non-solvent for the polymer (such as glycerol, ethyl alcohol). The vaporizable organic liquids are now distilled off, leaving a stable aqueous dispersion of the polymer alone. This general method seems quite valuable, especially for plastics which are difficult to disperse directly, yet which are undesirable when mixed with organic solvent.

An ingenious device is utilized in a new automobile polish that has a condensation product of castor oil with oleic acid or a phenol or phthalic anhydride as its main ingredient.[5] This resin, which is claimed to be superior by virtue of its proper index of refraction for lacquered surfaces, is dispersed in a petroleum hydrocarbon which in turn is dispersed in a solution of soap (potassium oleate) and a natural gum in water. Volatile mineral spirits may be used to reduce the viscosity as well as to aid in the cleaning; ortho-dichlorbenzene, a good solvent for tar and road oil, also is suggested as an ingredient. In applying the polish, the double dispersion breaks down. The resin enters the tiny cracks in the lacquer and the liquids are absorbed by the polishing rag.

In certain cases, it is necessary to resort to unusual artifices. Ethylene polymers have, since their first production, attracted considerable attention and thought, for these tough, high molecular weight hydrocarbons could readily and cheaply be prepared on a large scale. Unfortunately their limited solubility in organic solvents and high melting points have hindered their application. In such instances the dispersion technique is indicated. The difficult problem of dispersing these waxes in water has recently been solved

* Glycerine Producers' Association.

[1] J. Soc. Chem. Ind., Japan, 43, supplem. binding 350 (1940); Chem. Abs., *35*, 1893 (1941).

[2] Imper. Chem. Ind., Ltd., & Wm. Baird, Brit. Pat. 340,988 (May 27 1931).

[3] I. G. Farben. Akt., Brit. Pat. 334,567 (Sept. 8, 1930).

[4] W. Daniel and M. Otto, U. S. Pat. 2,296,427 (Sept. 22, 1942).

[5] J. A. Tumbler, U. S. Pat. 2,289,392 (July 14, 1942).

according to Messrs. A. M. Alvarado and G. L. Dorough.[6] While holding the polymer at a temperature a little below its melting point, a soap and a protective colloid are worked in and the mass then mixed with water until completely dispersed. Such preparations are excellent for textile, paper and leather impregnation.

This brings up still another method for the preparation of aqueous dispersions suggested by E. W. Scripture, Jr.[7] The substance to be dispersed is melted, mixed with the emulsifying agent (such as sodium stearate) and atomized with a sprayer. As the fine spray settles, it solidifies into a fine powder which may be stored indefinitely before mixing with water. The advantages of this mode of preparation are obvious: storage space, and shipping and container costs are considerably reduced. While this method, unfortunately, is limited to comparatively few resins, it seems possible that it may be applicable to solutions of plastics in volatile organic solvents.

The textile industry, because of its ready responsiveness to consumer demand and fashion influences, is one of the most active investigators of new plastics dispersions. One new textile finish[8] which is claimed to strengthen the fabric, give superior body, brighten the colors, impart runproof properties to hosiery and make starch, talc, softeners and the like stick much better, consists of a soap and water emulsion of a polyhydric alcohol ester of a rosin having a suitable melting point. This thermoplastic resinous material has the important advantage, like other plastics of withstanding a considerable amount of washing.

Cellulosic textiles may be made creaseless and their resiliency increased by forming a synthetic resin within the material.[9] A dispersion of an intermediate condensation product or polymer in soap water is applied to the cloth which is then heated to complete the condensation of polymerization. Many resinous substances such as the acrylics, vinyl alcohol and esters, or the alkyds may be used.

In addition to the above types of plastic dispersion and to still others, the ethylene polymer and dispersions mentioned in connection with reference 4 also are suitable for textile finishing. A great advantage of resin emulsions as against solutions is that a continuous waterproof film can be applied while retaining the limpness and "feel" of the fabric. It should be pointed out here that such films make excellent "barrier" bases for subsequent coating with other types of materials since saturation of the fibers is prevented.

Plastics chemists are continually on the lookout for new developments in protein plastics since the cheapness and abundance of milk and vegetable proteins constitute a tempting incentive for development. The unfortunate characteristic of protein plastics, however, is that they are nothing more than proteins, subject to attack by water, alkalies and the like. A completely new material derived from any of the common proteins may now be made, according to a recent report,[10] by utilizing the active amine and carboxyl groups of the protein molecules. The protein is heated several hours with a polyhydric alcohol or a mixture of such an alcohol with a fatty acid, together with a stabilizing catalyst which acts to prevent hydrolysis and catalyzes formation of the resin. The final product then may be dispersed in water by means of soap to yield an excellent vehicle for a paint or coating composition. The exact nature of the product is not clear, but it seems likely that ester and amide linkages with the protein are formed as well as ester linkages between the alcohol and fatty acid. A typical formula calls for heating a mixture of casein (10 parts), diethylene glycol (2.5), water (50), pine oil (1) and sodium formate (1) for 2 to 3 hr. at 160° to 170° F.

An odd use of soap in connection with synthetic casein fibers is described in an Austrian process.[11] The casein, together with an antiseptic, is dissolved in a solution of sodium hydroxide, and an appropriate amount of soap added to adjust the viscosity of the spinning solution which is to be ejected from a tiny orifice into a coagulating bath.

Reminiscent of references 9 and 10 is a waterproofing process[12] that calls for impregnation of the textile with a solution of an albumen or globulin, coagulation of the protein by steam and then treatment with a hot solution of soap and fatty acid (made by acidifying a soap solution). A wax dispersion may with advantage be added to the protein bath. It is possible that a new resin or a complex is formed between the denatured protein and the fatty acid. According to the inventor this proofing is fast not only to laundering but also to a considerable extent, to dry cleaning.

The odor of linseed oil and turpentine may not accompany your painter when he comes to your house or factory after the war. For if he uses a water-base paint, and the chances are he will, you will find the paint drying in a few hours without the liberation of flammable and noxious fumes, to form a coating of unusual opacity, durability and water resistancy. You may thank the plastics chemist, the dispersion technique as well as the entire field of chemistry, for this very practical miracle. One such paint[13] is made by emulsifying in soap and water a solution of an alkyd resin in ammonia, alcohol, glycerol and other ingredients. The dispersion is then sprayed or slowly added to a very fast mixer containing a mixture of fillers and various aids, resulting in a dry powder which can be shipped as such. Before use, the powder is mixed with water. It is interesting to note here that the soap now performs a second function. We are told that this versatile substance acts to thicken the final product and thus make it more suitable for brush work.

New resins are finding their way into this actively developing field. The triazine resins (derivatives of melamine) have been emulsified with soap and water to produce dispersions suitable not only for coating but for the manufacture of textile inks and fabric finishes.[14] The triazines also may be mixed with other resins, miscible cellulose ethers or esters, and plasticizers.

Another interesting and new plastic that has been used as a soap and water dispersion for coatings is described as being rubbery, elastic, non-reactive, non-oxidizing, essentially infusible and heat-nonconvertible.[15] It is prepared by mixing and heating a urea-formaldehyde-alcohol condensate with an oil-modified, non-drying alkyd resin (which is insoluble in organic solvents), together with appropriate modifying agents to increase the hardness, gloss or plasticity of the final product. This condensate then is dispersed in a solution of a protective colloid (methyl cellulose) and soap in water. The flexibility and transparency of the plastic make it especially suitable for application to metal foils.

The plastics industry is making another major contribution to the Allied war effort by replacing natural or synthetic rubber in leather cements. (*Please turn to page 146*)

[6] A. M. Alvarado and G. L. Dorough, U. S. Pat. 2,290,794 (July 21, 1942).
[7] E. W. Scripture, Jr., U. S. Pat. 2,284,023 (May 26, 1942).
[8] W. M. Billing, U. S. Pat. 2,288,432 (June 30, 1942).
[9] D. Finlayson and R. G. Perry, Brit. Pat. 485,198 (May 16, 1938).
[10] F. C. Atwood, U. S. Pat. 2,298,209 (Oct. 13, 1942).
[11] A. Ferretti, Austrian Pat. 157,091 (Sept. 25, 1939) (Cl.29b).
[12] E. B. Higgins, U. S. Pat. 2,250,377 (July 22, 1941).
[13] C. Barrell, U. S. Pat. 2,250,346 (July 22, 1941).
[14] Am. Cyanamid Co., Brit. Pat. 539,288 (Sept. 3, 1941).
[15] F. J. Myers, U. S. Pat. 2,293,164 (Aug. 18, 1942).

Plastics Engineering

F. B. Stanley, Engineering Editor

Transparent enclosures in aircraft

by ORLO E. BROWN* and WINFIELD H. ARATA, JR.*

CASUAL observation of two of Uncle Sam's most potent war planes, the Ventura and the Flying Fortress, served to indicate to the authors the lack of standardization in the installation of transparent enclosures. When other military airplanes were inspected, it was found that this absence of standardization was quite general. This fact is not surprising in view of the very rapid expansion of the aircraft industry during the past 3 years. With new planes coming from the drafting boards at an unprecedented rate, it is to be expected that each transparent enclosure installation will represent the best effort of a particular designer rather than the carefully selected result of long practice. Many excellent designs have been produced but also some with inherently bad features.

Plastics are new materials to many designers, a fact which has contributed to the complexity of employing windows of compound curvatures. The need for repairing and replacing transparent enclosures in far-flung and often ill-equipped stations makes the need for good installations of primary importance. It is the purpose of this article to point the way toward standardization. By enumerating the design criteria which control good practice and by illustrating typical installations, it is hoped that both good and bad features may be shown in their true light.

The problems of transparent enclosures stem mainly from the character of the materials used. As listed in Table I, there are 6 possibilities, 5 of them plastics. The sixth, plate glass, is of decreasing importance due to its weight, and to its inability to be contoured. While data will be given on plate glass, this article is concerned primarily with plastic enclosures and the problems attending their use.

Handling—In dealing with windows, noses, turrets and similar plastics parts, common methods of stocking and handling must give way to special techniques in order that excessive spoilage be avoided. The essentials of handling such enclosures are as follows:

1. Immediately after being formed to the correct contour, plastic enclosures must be protected against surface abrasion. There are 2 general methods: by paper masking and by lacquer spray masking. The paper used in masking is a heavy grade made to stick to the plastic by means of rubber glue. Because of the critical shortage of rubber glue and because

* Production design engineers, Vega Aircraft Corp.

PHOTO, COURTESY VEGA AIRCRAFT CORP.



TABLE I.—PROPERTIES OF TRANSPARENT ENCLOSURE MATERIALS

Property	Methyl meth	Allyl resin	Cellulose acetate	Ethyl cellulose[a]	Cellulose nitrate	Plate glass
1. Tensile strength, p.s.i.	5000–7500	6000	4000–11,000	7000–9000	6000–9000	6500–30,000
2. Compressive strength, p.s.i.	10,000–15,000	11,000	4000–30,000	10,000–12,000	20,000–30,000	36,000
3. Coefficient of linear expansion per deg. F. $\times 10^{-5}$	3.9–5.0	5	8–9	5–8	6.5–8.9	0.33
4. Index of refraction	1.49–1.51	1.51	1.49–1.50	1.47	1.50	1.52
5. Light transmission, %	90–92	82–91	85–92	91	90[b]	88–91
6. Specific gravity	1.18–1.20	1.32	1.27–1.37	1.08–1.18	1.33–1.60	2.5
7. Burning rate, 1/8-in. sheet, in./min.	1.1	0.35	1.5–2.0[c]	Slow	Highly inflammable	None
8. Solubility	Soluble in esters ketones and aromatic hydrocarbons	Generally insoluble	Generally soluble in organic solvents except hydrocarbons			Insoluble
9. Effect of age	Practically none	Slight	Slight shrinkage	Slight	Hardens slightly	None
10. Effect of sunlight	Practically none	Yellowing	Slight discoloration	Slight	Yellows and embrittles	None

a Up to 0.020-in. sheet only.
b Due to slight fogging of the exposed surfaces this figure decreases with exposure.
c 0.060-in. sheet.

of the difficulties in removing the paper and adhesive, this type of protection is being replaced by spray masking.

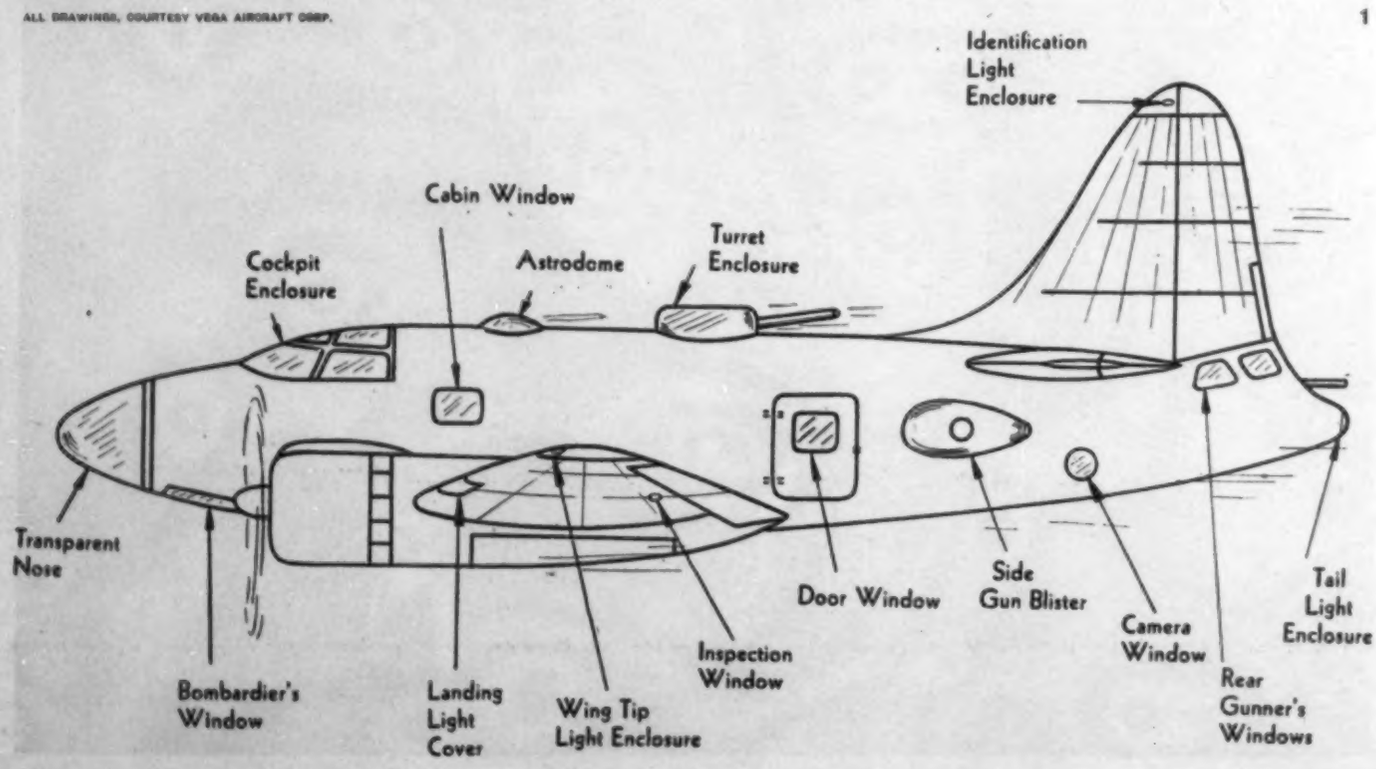
The selection of a suitable masking lacquer must be made with utmost care. While a number of commercial products are available, most of them cause crazing of the plastic surface particularly when used on methyl methacrylate. This crazing is of considerable importance. By seriously lowering the strength of the plastic, it makes a sizable cut in the margin of safety allowed by the designer. However crazing frequently is so fine that it easily may escape detection. No protecting lacquer should be used without adequate tests to prove that it does not so affect the kind of plastic to be coated.

A good masking lacquer should dry rapidly and give a film tough enough to resist handling as well as a reasonable amount of impact from tools while the window is being installed. It should be impervious to the solvents in zinc chromate primer, yet peel readily from the surface even after exposure to weathering. From the difference in the solubilities of the 6 plastics, it is evident that selection of the protective lacquer also must take into account the material on which it is to be applied. More work is needed in this field since the list of good lacquers does not include ones that are satisfactory for all of the plastics currently used.

2. All handling must be based on the concept of brittleness rather than on that of plasticity. With the exception of the cellulose plastics which show a high degree of toughness, it must be admitted that sharp impact or shock may cause cracking in any of the enclosure materials. The lower the

ALL DRAWINGS, COURTESY VEGA AIRCRAFT CORP.

1

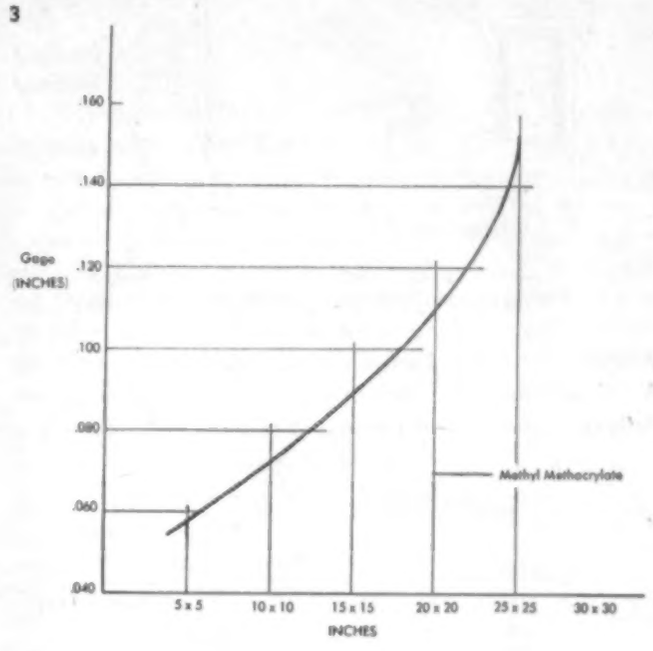


temperature, the more this is true. If the plastics are handled as carefully as though they were glass, no breakage will occur from handling. As with glass, the use of gloves by the workmen is strongly recommended.

3. Plastic enclosures should be stored in a special stockroom devoted to the one stock. This is necessary because of psychological as well as material factors. It is common practice to stack other stocked materials whenever space is at a premium. Plastic enclosures must not be stacked. In general, they must be fairly well supported so that no one section carries a heavy load or a stress tending to cause distortion. The supporting racks should be padded. The temperature must be relatively constant (free from sudden changes) and preferably between 60° and 80° F. Both gritty dust and solvent fumes are to be avoided. While these requirements seem to be known, there still are many instances where they are not met. The all-plastic stock room forms a simple and satisfactory answer even in cases of inexperienced factory personnel.

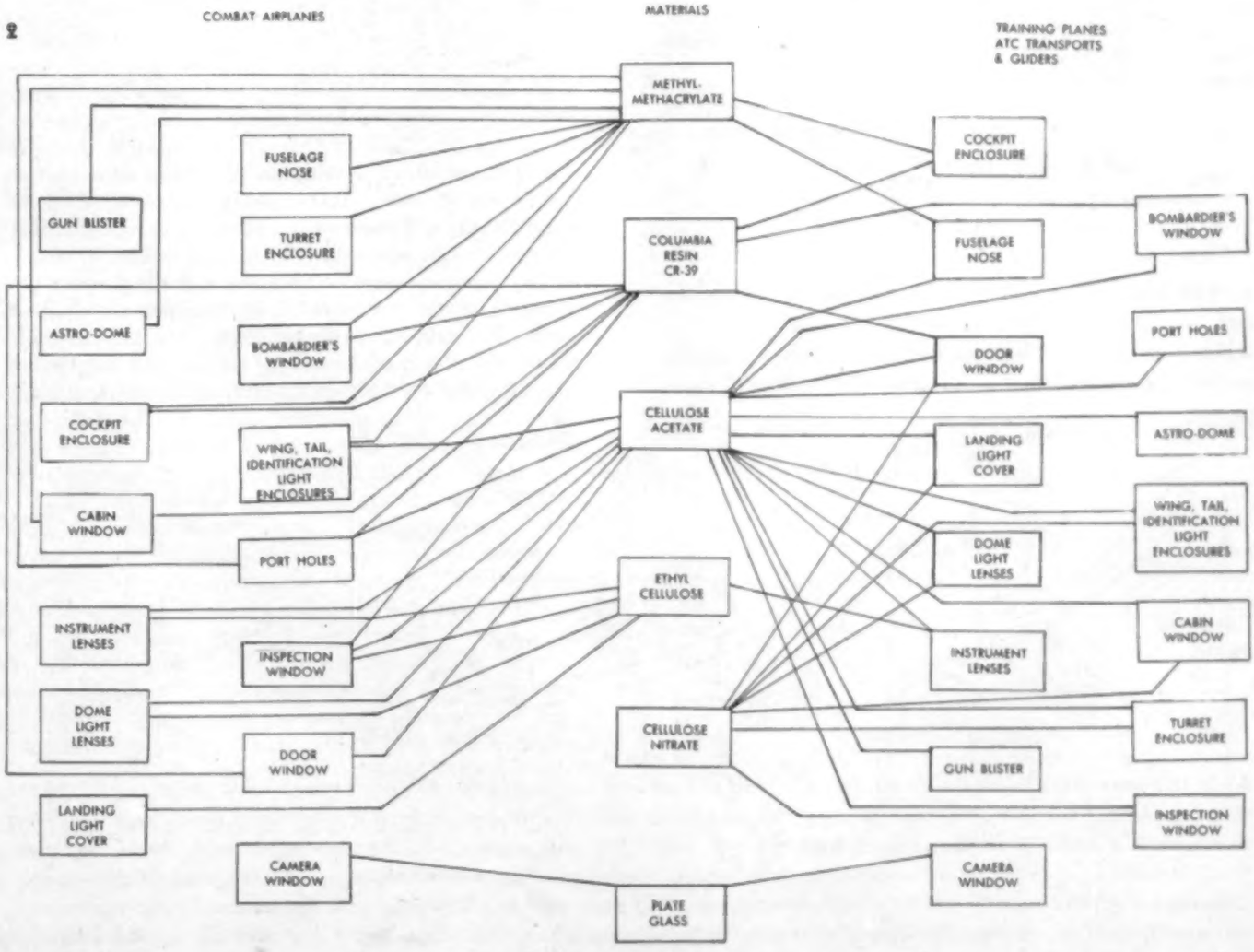
Choice of material—In making a choice of the proper material for a particular enclosure, only a few factors need be considered. First and most important is availability. Army directives and WPB orders prevent the use of the more critical materials in any applications except those designated by these Government agencies. Free choice no longer exists. Not only is this true of the enclosure materials, it is equally true of the rubber-type backing strip and of aluminum extrusions for frames. So critical is the supply of extrusions that designs based on their use (see Figs. 5, 11 and 17) should be avoided whenever possible. With respect to the plastics,

3

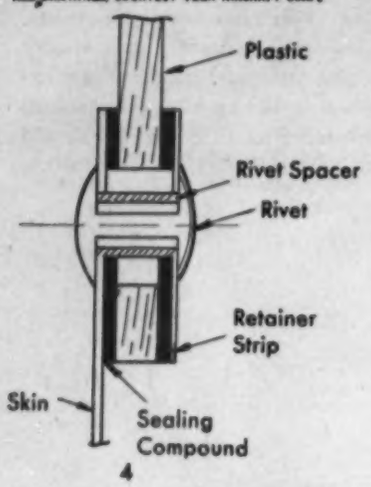


1—This drawing indicates the various applications of transparent plastic enclosures in aircraft. 2—This chart shows the application of various transparent materials which are approved at present. 3—A graph indicating the maximum recommended window size in aircraft

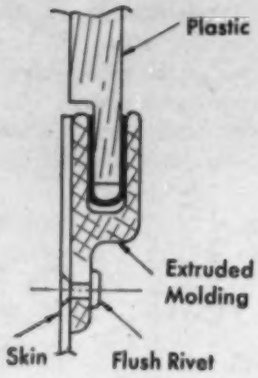
2



ALL DRAWINGS, COURTESY VEGA AIRCRAFT CORP.



4

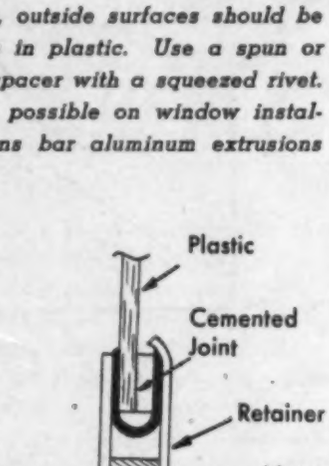


5

4—On window installations, outside surfaces should be flush. Avoid drilling holes in plastic. Use a spun or hollow rivet rather than a spacer with a squeezed rivet. 5—Sloppy or tight fits are possible on window installations. Procurement reasons bar aluminum extrusions



6



7

6—Two sets of screws must be removed before the window can be taken off the airplane. 7—The design of this window installation will prevent flexing under tension loads. Cemented joints mean extra assembly operations

no general rules can be given for determining which ones will be most available. Not only is there considerable difference in the monthly production of the various plastics, but also the effect of the allocation orders is to cause sudden shifts in use. However, it is possible to state that plate glass is least critical and methyl methacrylate is most critical at present under current allocations.

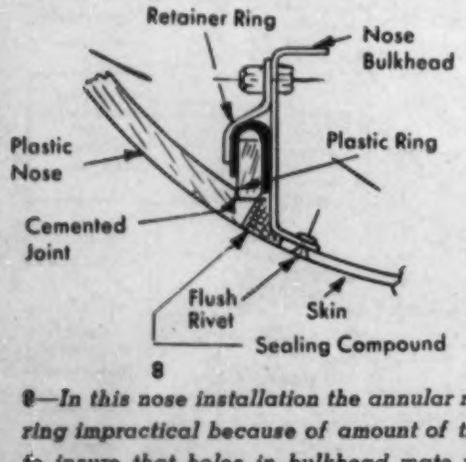
Factors other than availability are of considerably less importance. Only the possibility of crazing is apt to introduce a design penalty which can alter the choice in material. Certain installations are more subject to wetting by gasoline, oil and de-icing fluid and, in consequence, more apt to craze. Of the enclosure materials now in use, only allyl resin and plate glass are free from crazing possibilities. With the other 4 plastics, the following precautions are good practice in order to avoid crazing:

a. Use single rather than multiple contours
b. Use radius at cut-outs rather than sharp angles
c. Polish edges
d. Give strain relief
e. Avoid concentration of strains during installation

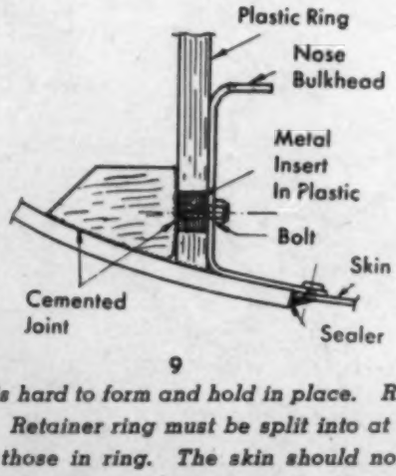
TABLE II.—METHYL METHACRYLATE, DIMENSIONAL CHANGE WITH TEMPERATURE

Temperature, Deg. F.	*Coeff. of expansion per deg. F. × 10^{-5}*
160	5.2
100	4.8
70	4.6
30	4.0
0	3.4
−30	2.9
−65	2.5

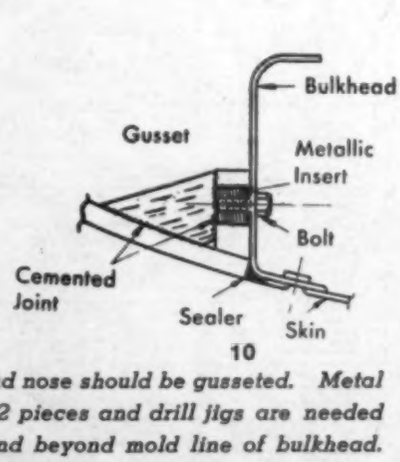
Any of the plastics (but not plate glass) may be machined or shaped like wood or metal if overheating is avoided. Corrections for slight differences in physical values can enable any of the 5 to give satisfactory service in aircraft. However, actual use is somewhat more restricted and Fig. 2 shows the applications of the various materials which are approved at present. By comparing the values of Table I with uses given in Fig. 2, a good basis may be obtained for judging any new installation. Figure 3 and Table II add additional



8



9



10

8—In this nose installation the annular ring is hard to form and hold in place. Ring and nose should be gusseted. Metal ring impractical because of amount of trim. Retainer ring must be split into at least 2 pieces and drill jigs are needed to insure that holes in bulkhead mate with those in ring. The skin should not extend beyond mold line of bulkhead. 9—This nose held to plane by accessible bolts whose tension must be limited to keep cold stressing of plastic low. Gussets are spaced equally around periphery and nose must mate with bulkhead contour. The external joint is poor from an aerodynamic standpoint. 10—This nose has better aerodynamic properties than Fig. 9 and does not overlap bulkhead

data. The question of service from plastic enclosures therefore resolves itself into a matter of good design.

Design of enclosure installations

Sealing and backing—Aircraft windows must be mounted with soft strip between the metal frame and the transparent material. Besides absorbing shock and vibration, this backing material compensates for unevennesses in the frame, weather seals, and tends to make uniform the pressure on the "glass." Among the materials used for backing are soft plastics, putties, cork and natural and synthetic rubber The minimum permissible thickness for backing is $^1/_{16}$ in. and the material should have a durometer reading of 40 ± 10.

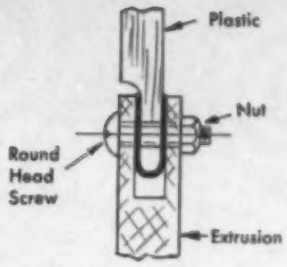
The backing strip does not alone solve the problems of pressure on the enclosure. As noted in Figs. 21 and 22, a breather space must be provided to allow for expansion. With methyl methacrylate and allyl resin, the space should be 0.002L. The cellulose plastics require 0.003L, while plate glass needs no such space. All types of clamping of the plastic material must have sufficient fluidity to permit use of the breather space when expansion occurs. When properly mounted a plastic will not shatter on impact of a bullet although none of the transparent enclosures listed is bullet-proof. Eventually there must be an improvement in backing materials to give better sealing. No window now in service in military aircraft is suitable for pressure cabins.

Use of holes—While it will be noted that most present window installations require holes in the plastic (Figs. 4, 6, 11, 12, 13, 15, 18 and 19) it nevertheless is true that holes should be avoided (see Figs. 16, 17 and 20). It might be well to point out that the best all-around design now in use is typified by Fig. 16. When a design does call for holes, they must be drilled, never punched. Holes in methyl methacrylate must be smoothed to counteract the notch sensitivity of the material. Since a smoothness of RMS 2 to 4 is required, this means that each hole should be buffed.

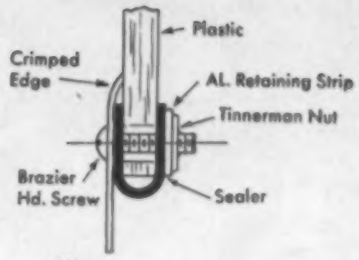
An edge distance of $2^1/_2$ to 3 times the hole diameter is advisable with methyl methacrylate and allyl resin. Holes also must provide for expansion by being oversize the same amounts as are given for the breather space. For example, a 20-in. methyl methacrylate panel will require holes 0.04 in. oversize while a similar panel of ethyl cellulose should be $^1/_{16}$ in. oversize. The ideal condition is to have this extra space concentric with the installation holes in the frame. Since this in practice is a difficult condition to meet, the most satisfactory answer is the use of slots to the edge of the panel rather than round holes in the plastic. The usual and the preferred designs are pictured on Fig. 14.

Use of gussets—Many assembly headaches have resulted from use—and misuse—of gussets. The ease with which plastics may be drilled and tapped has resulted in the use of standard tapped holes for attachment. However, such assembly is not good under stress, vibration or temperature change. Cemented joints are reasonably satisfactory when used as illustrated in Figs. 7, 8, 9, and 10. Such a joint will show 90 percent sheet strength when made at room temperature and 100 percent strength if made with unfilled adhesive and baked. Locating points always should be employed, and cemented surfaces must mate. Even in joints, the peculiarities of each material must be recognized. For example, Fig. 9 is not well suited to methyl methacrylate because there is a sharp angle at each end of the gusset joint. In general, plastics should not be used as stressed gussets or in lieu of corner plates.

Tolerances—One of the reasons that window installations must have lateral dimensional (*Please turn to page 140*)

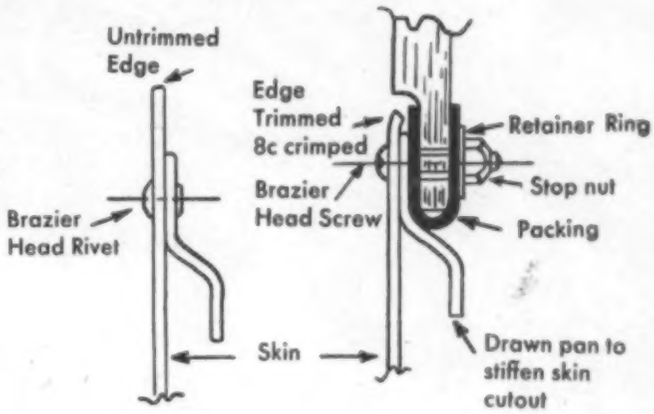


11



12

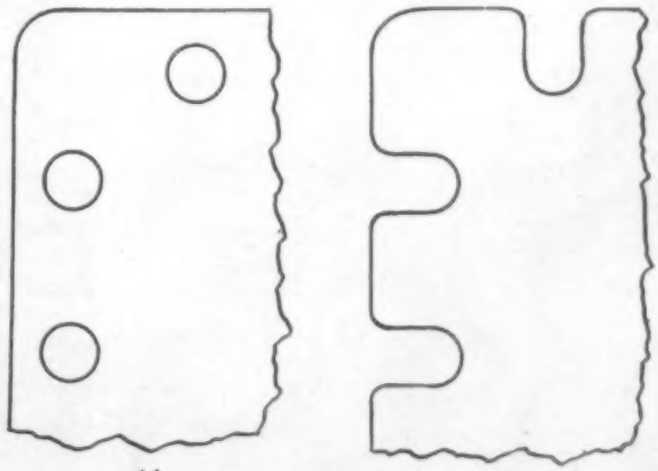
11—*On this window the routed surface means an extra operation; flush screws are preferable. This is of poor design since clamping action will tend to squeeze plastic, and there is poor delivery of extrusion.* **12**—*A thicker window is necessary because of lack of frame stiffness. Both crimping and drilling are extra operations. A flush screw and light-weight Tinnerman nuts are desirable*



Before Mounting

13

13—*In this window the drawn pan is a good compromise between stress and production. The plastic rides on rivets. The skin is hand trimmed on assembly and back drilled from pan. Screws must miss rivets. The frame is drilled on assembly line both for rivets and bolts. This is stronger design than Fig. 11. Since plastic was cut back for flush surface, brazier head screws are used*



14

14—*In the use of holes the best answer is slots to the edge of the panel (right) rather than holes (left)*

117-FOOT LAMINATED WOOD SPANS—

Safely Bonded



Cross section of span permanently laminated with Plaskon Resin Glue

PLASKON

TRADE MARK REGISTERED

★ RESIN GLUE ★

PLA
2121 S

...with Plaskon Resin Glue



THE unbreakable grip of Plaskon Resin Glue is proved by these long, amazingly strong laminated wood arches, now being used for the speedy construction of essential military structures. Each section of each 3-hinged span is made up of thirty-seven ¾" x 8" boards . . . and each span stretches unsupported from ground to ground for 117 feet, with a rise of 44 feet!

Neither moisture, cold nor heat can lessen the strength of these Plaskon-bonded spans, for Plaskon Resin Glue itself is completely waterproof and weather-resistant. Mold or fungus cannot destroy its holding power. Gasoline, oil, and common solvents have no effect upon its remarkable holding powers. Because these features assure an unusual degree of permanence in many different types of manufactured articles, Plaskon Resin Glue is being widely used as the bonding agent for paper, wood and fabrics. It offers many opportunities for new post-war product developments.

The list of highly important war goods made with Plaskon Resin Glue includes merchant ships, assault and landing boats, supply barges; airplane propellers, fuselages, wings, noses, pilots' seats; prefabricated houses; and many other products to meet unusual service requirements. Our ability to supply Plaskon for molding and adhesive purposes depends directly upon W. P. B. Allocation Order M-331.

PLASKON DIVISION, LIBBEY • OWENS • FORD GLASS COMPANY

2121 SYLVAN AVE., TOLEDO 6, OHIO • Canadian Agent: Canadian Industries, Ltd., Montreal, P. Q.

The blowing of plastics

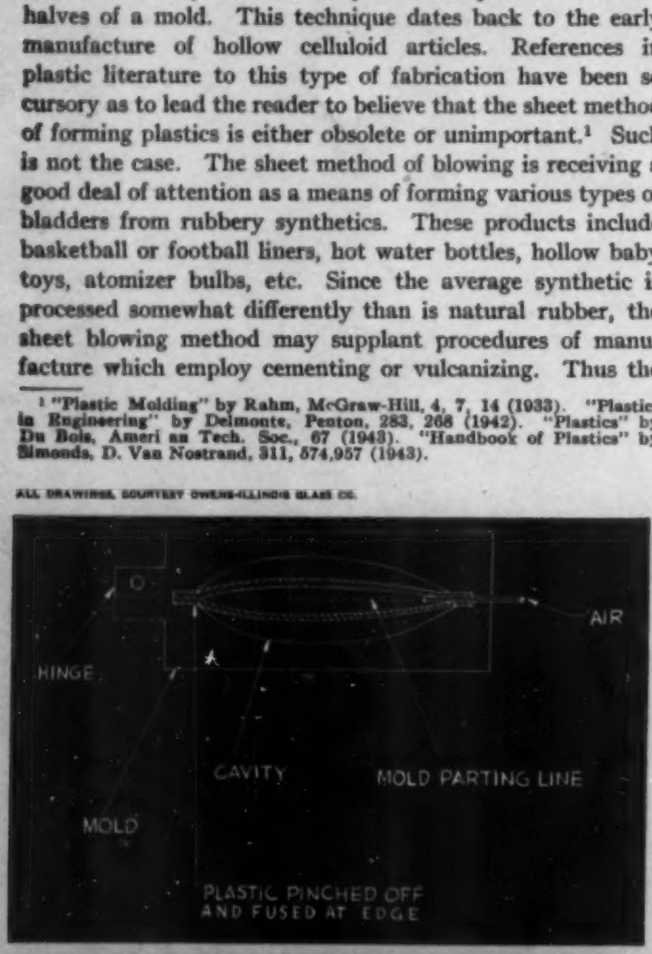
THE past year has seen the development on a commercially feasible scale of new methods for the blowing of various plastic materials. In addition, research into the different ways of expanding plastics has been carried on, utilizing a variety of principles some of which are discussed in the following paragraphs.

The first and oldest method of blowing plastics is the expansion of plastic sheets by the introduction of air or steam between the layers while they are clamped between the halves of a mold. This technique dates back to the early manufacture of hollow celluloid articles. References in plastic literature to this type of fabrication have been so cursory as to lead the reader to believe that the sheet method of forming plastics is either obsolete or unimportant.[1] Such is not the case. The sheet method of blowing is receiving a good deal of attention as a means of forming various types of bladders from rubbery synthetics. These products include basketball or football liners, hot water bottles, hollow baby toys, atomizer bulbs, etc. Since the average synthetic is processed somewhat differently than is natural rubber, the sheet blowing method may supplant procedures of manufacture which employ cementing or vulcanizing. Thus the number of operations necessary to produce hollow, collapsible items which use valved filling stems or suitable openings may be reduced.

[1] "Plastic Molding" by Rahm, McGraw-Hill, 4, 7, 14 (1933). "Plastics in Engineering" by Delmonte, Penton, 283, 268 (1942). "Plastics" by Du Bois, Ameri an Tech. Soc., 67 (1943). "Handbook of Plastics" by Simonds, D. Van Nostrand, 311, 574,957 (1943).

ALL DRAWINGS, COURTESY OWENS-ILLINOIS GLASS CO.

1



2

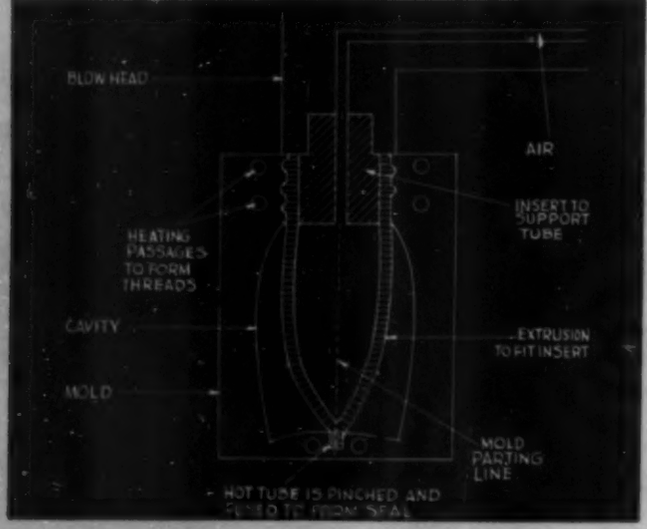


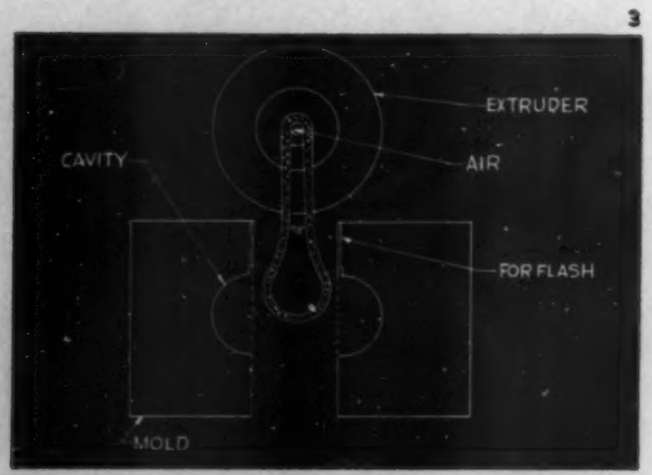
Figure 1 illustrates the forming of an oval bag by the sheet blowing procedure. Here the sheets, pictured as partially expanded by internal pressure, are clamped between the mold halves where pressure and heat nip and fuse the edges. When thermosetting materials are formed by this method, the temperature of the molds is raised and higher temperature steam is used for blowing. It is not the purpose of this article to elaborate on such a conventional and established process, but to indicate to prospective users at least 3 new methods for forming hollow plastic articles which soon may be available on a wide scale.

The first of these methods consists of the use of an extruded tube in place of the conventional sheet. The section of tube is softened and placed between 2 halves of a mold. Steam or some other suitable heating medium is introduced under pressure through a metal insert which is placed in the upper end of the tube to support it while the threads or finish of the article are being molded. This pressure forces the plastic to expand and, when it is evenly heated, to take the shape of the finished mold. As the mold closes, the bottom of the mold clamps the lower end of the tube thereby preventing the escape of pressure. This clamping action not only helps form a tight weld at the end of the tube but also nips off any unused portion so as to produce a smooth internal and external finish. While this process is somewhat related to the older sheet method, the use of extruded tube sections or preforms fed in succession to the blow mold, brings one step nearer the realization of an automatic blowing machine which will turn out hollow plastic articles at a high rate of speed. Anyone who is at all familiar with the blowing of glass containers should have no difficulty in envisioning a continuous automatic machine for applying pressure and heat to appropriate extruded preforms.

Figure 2 outlines the use of the extruded preform method and shows the tube in the mold ready for blowing. Threads are produced as the mold closes around the insert. The bottom of the container is formed by pinching the hot sides of the tube together. Hot fluid or steam thus may expand the preform or tube to final shape.

The second modern method of blowing thermoplastics to

3



receive extended development during the past year is somewhat related to the extruded tube process already described. At present, this process seems better adapted to the forming of hollow closed articles such as decorative Christmas tree balls, floating toys and toilet ball floats, since a finishing operation would seem to be required if screw thread containers were blown by this method. This process is believed to utilize an extruder wherein the plastic is softened and prepared for molding. As the plastic is extruded, air is introduced. Since the end of this softened plastic tube has been collapsed and sealed in the forming of the previous piece, the extrusion begins to swell. At this point, an open mold carried on a rotary table presents itself to the expanding extrusion and closes upon it. The blown plastic is nipped off, and the rotary table moves on one station. After forming, the hollow article is expelled from the mold when it finally opens at the discharging station. The details of this process and of the mechanism employed are zealously guarded secrets. However, some of its benefits already are being given to the public. The careful observer will recognize items made in this manner which are now finding their way into current trade channels.[1]

The extrusion method of forming hollow plastic objects is indicated in Figs. 3 and 4. In these diagrams the expanding extrusion is about to be seized by the mold. Since the process functions at comparatively high speed, air is introduced into the material stream in relatively large volume causing the bubble shown in the sketches to fill rapidly and stretch the plastic to the desired wall thickness before the closing of the mold nips off the material stream.

It is but a step from the above method to an adaptation of the ribbon process used in the manufacture of glass light bulbs. The inventive engineer can easily envision a process in which a stream of extruded plastic flows into a series of continuously moving molds and where a blow head comes down and expands the plastic ribbon as it begins to fall into the mold so that it fills the cavity evenly. It is the adaptation and perfection of processes such as this that offer prospects for fruitful research into the new uses of plastics.

The third type of plastic blowing upon which considerable research has been carried out during the past year involves the expansion of injection molded blanks while they still retain the injection heat. In this method a blank is injected into a hot mold (heated to about 325° F.) around a heated hollow core or insert. After injection the blank, or hot lump of plastic, is removed from the injection machine and placed in a cold mold. Air at around 80 lb. pressure is introduced through the hollow core, and the plastic is expanded to take the shape of the blow mold. If temperature conditions are scientifically controlled it has been found possible by this method to readily produce hollow articles of almost any description. The finish or thread is formed at the time of injection through use of a threaded collar which also supports the blank during blowing. This collar is later removed.

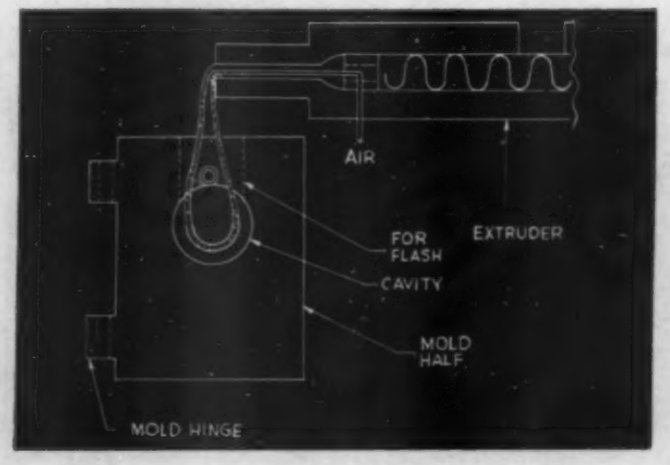
The blowing of the hot injection molded blank or preform to make an unbreakable plastic container is outlined in Fig. 5. The hot blank together with the finish or thread-forming insert is placed in the blow mold ready for the air pressure to be turned on. This air which enters through the hollow shaft forces the plastic outward from the core to form an even-walled section over the interior surface of the blow mold.

Undoubtedly the future will see an automatic machine for injecting the blank, clipping off the runner, transferring the preform to a blow mold and ejecting the finished article. This blowing method opens many possibilities for new uses of plastics which could not be attempted in the past without molding the parts in halves and cementing them together with the attendant expensive problems of fixtures, buffing, handling, etc. Particular notice should be taken of the internal surfaces of blown plastics which have a lustre and smoothness seldom obtained where the plastic touches a metal cavity as it does in ordinary molding. Blow molds may be made of cast iron, aluminum or other inexpensively worked material thereby allowing lettering and designs to be reproduced at low cost. The list of items which can be made by this method is being extended to include so many different things that the method's only limitation may be said to lie in properties of the material selected and in the ingenuity of application. Experiments show that most but not all plastics and synthetics appear amenable to treatment by blowing. Consequently a suitable material can almost certainly be located for every use.

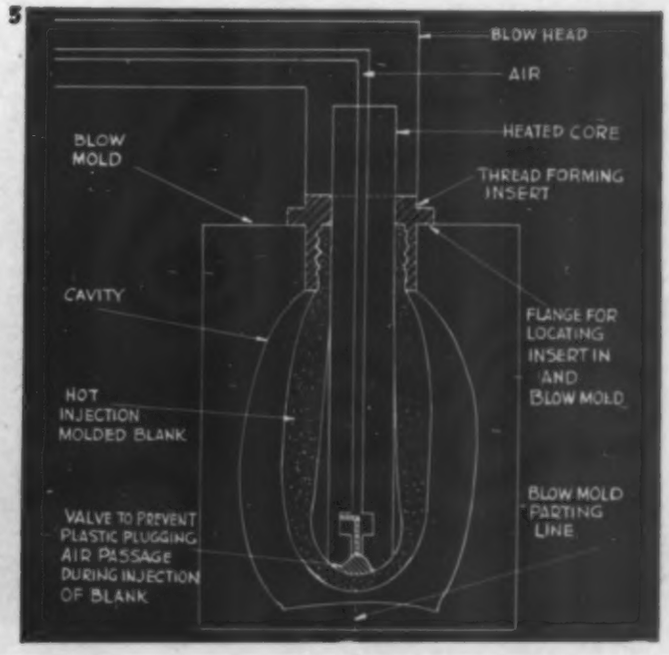
[1] "A Blowing Process for Thermoplastics," MODERN PLASTICS *20*, 46 (Dec. 1942).

1—Sheet blowing method with sheets clamped between mold halves. 2—Extruded preform method showing bottom of tube clamped by mold. 3—Blown extrusion method with gob suspended in mold. 4—Blown extrusion before full size is reached. 5—Preform blank suspended in mold

4



5



Life ON THE PLASTICS NEWSFRONT



(*Above*) **ICE-FREE PROPELLERS** are assured by anti-freeze liquid pumped from this laminated tank built by Crosley Marine for installation on army bombers.

(*Below*) **WATER FOR THIRSTY BOMBARDIERS** is supplied from this water breaker shown unassembled. It is low-pressure laminated with tough, durable LAMINAC®.



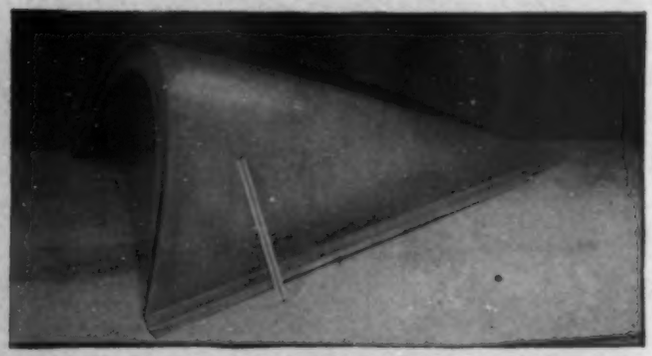
COMPLEX LAMINATED SHAPES MADE POSSIBLE BY LAMINAC

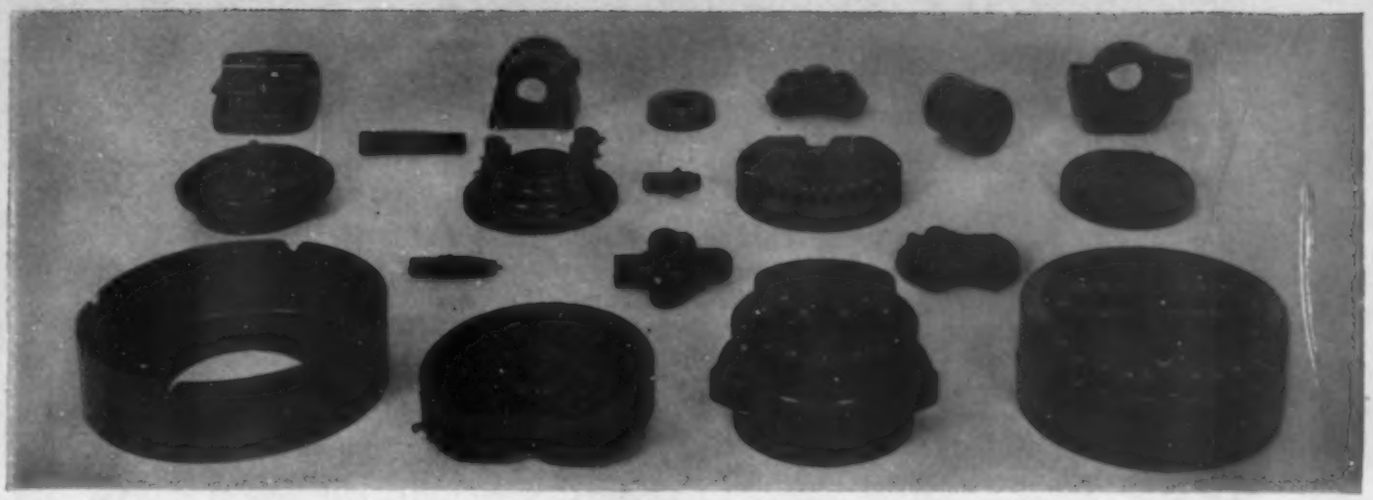
An outstanding achievement in low-pressure laminating was the development by Cyanamid's laboratories of a thermo-setting liquid resin which so simplifies building up wet fabric in a mold as to make possible the production of laminated pieces in extremely complicated shapes. Known as LAMINAC, this resin possesses remarkable bonding strength at mere contact pressure. Rapid curing time, easy impregnation of fillers, and the exceptionally high strength of resulting laminates make LAMINAC well suited for the production of flat or curved objects by low-pressure molding methods. Excellent laminates may be produced with this resin by using contact pressure between steel or glass plates, or simply by wrapping about a mold under tension. This resin permits the use of relatively inexpensive laminating equipment for the production of objects having either flat or curved surfaces. The products shown on this page are typical of those that are fabricated with this material by Crosley Marine and others. Cyanamid will gladly supply information about LAMINAC or any of the other products listed below.



(*Above*) **NEARLY ANY SIZE TANK** can be laminated by the use of this flexible tube winding machine designed by Crosley Marine.

(*Below*) **EVEN PARTS OF THE PLANES THEMSELVES,** such as the engine fairing shown here, are laminated with LAMINAC.





(*Above*) **PROPER FUNCTIONING** of aircraft ignition systems built for practically all aircraft engines by the Scintilla Magneto Division of Bendix Aircraft Corporation is aided by these plastic parts. Ranging from large 18-cylinder distributor assemblies down to small terminal sleeves, they are all molded from MELMAC* 592—a mineral-filled thermo-setting plastic developed by American Cyanamid which is finding wide application in the electrical field because of its high dielectric strength (430 Volts/Mil.), high arc resistance (130 sec. ASTM average), and high heat resistance (300° F.). This melamine-formaldehyde material has proven that it can withstand virtually any condition of service from the extremes of high altitude cold to torrid tropic heat. MELMAC 592 is continually being adapted or modified to meet new and specialized requirements. Perhaps this plastic can help *you* in meeting today's needs or planning tomorrow's designs. Further information and data sheets will be sent on request.

(*Right*) **READY FOR THE TAKE-OFF,** is this tableware molded of MELMAC 1077, part of the table service on planes operated by American Airlines. Because it is exceptionally light weight, strong and shatter-resistant, this plastic is widely chosen for such use. MELMAC 1077 is sanitary because of its hard, low moisture-absorbing surface and its resistance to staining. Although now restricted, MELMAC 1077 can be produced in many beautiful, permanent colors.

(*Below*) **A PLASTIC PLYWOOD PIANO PLATE** has been developed by the research of the Weaver Piano Company, which not only saves critical materials but is said to produce a sweeter, mellower tone than conventional metal plates. Made of birch and maple plywood laminated with plastic glue, the new plate is considered an engineering achievement because it carries a string tension of more than eighteen tons in an intricate pattern of stress. Pianos utilizing these plywood plates are currently being made for the armed forces.





PHOTO FROM AMERICAN AIRLINES, INC.

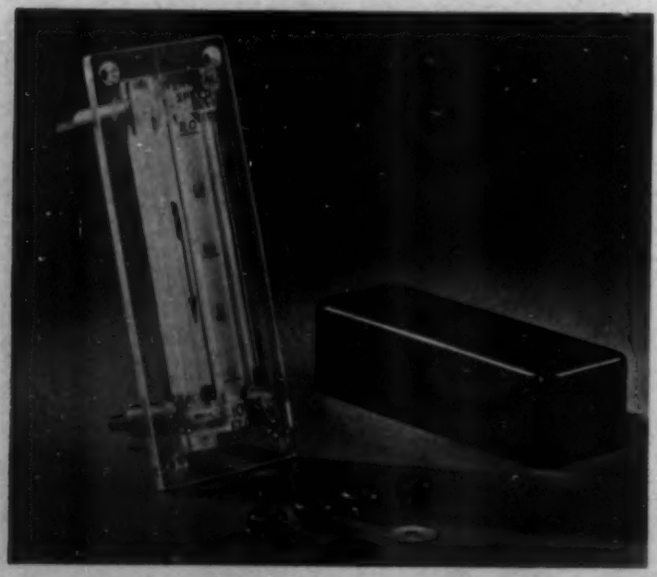
*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
30 ROCKEFELLER PLAZA, NEW YORK, N. Y.
CYANAMID PLASTICS · Beetle · Melmac · Urac · Melurac · Laminac

Vertical speed indicator

A CLEARLY readable, quick-acting and accurate instrument for registering vertical rate of climb or decent is one of the more important instruments in use on all aircraft. Not only is its use mandatory on all heavier-than-air machines, but it is also essential to the operation of the lighter-than-air ships.

Instruments of this type are manufactured with the closest of tolerances, these rigid requirements being set up by our Army Air Forces. Any molder who has had experience in molding aircraft instrument cases will instantly recall the accuracy and extremely close tolerances which were necessary in their production. Considering that the accuracy of the instrument must be far greater than that of the case in which it is housed, it is remarkable that a large molder and fabricator in the Middle West has undertaken the production of a vertical speed indicator manufactured almost entirely from plastic materials (Fig. 1). Injection molded with sections of .005 in. and tolerances of .0005 in., the instrument is made up of 4 separate plastic parts: the tubes or indicator body, 2 indicating pellets and the housing.



1

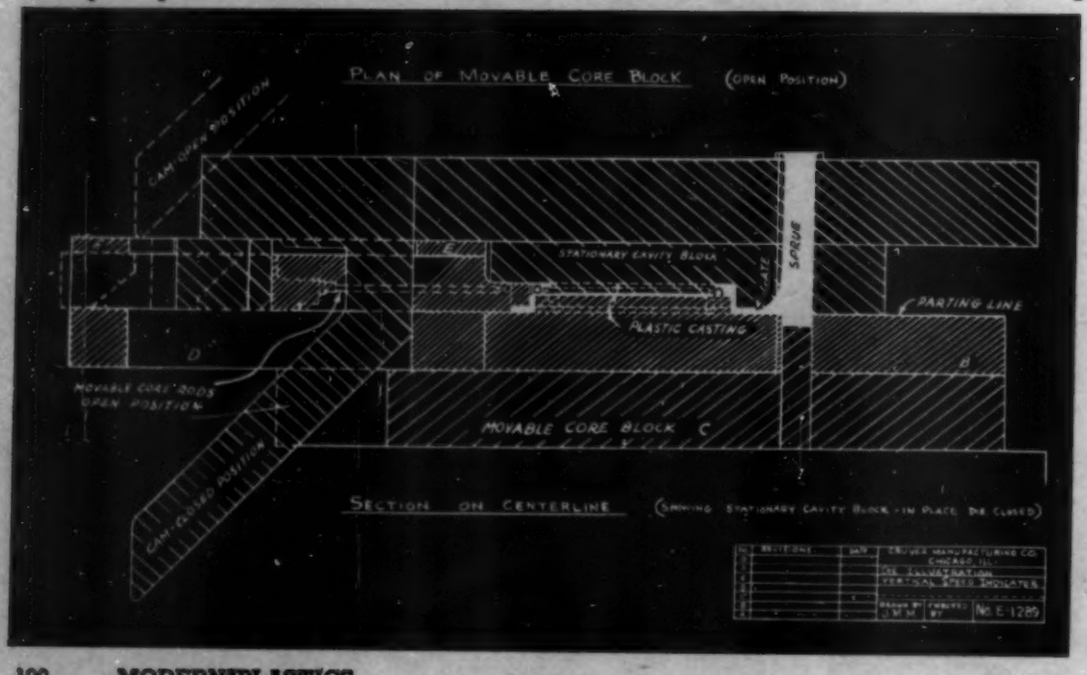
The transparent indicator body is molded of methyl methacrylate. The drawing of this part (Fig. 2) shows clearly the 2 long tapered indicating tubes which are molded as an integral part of this body, and 4 small molded-in holes opening into these tubes. The problem here, of course, is to mold these holes in such a manner that their openings into the long tubes are free from flash. The slightest bending or out of alignment of the fragile mold pins would result in the part's being rejected. The 4-in. long pins which mold the $^1/_8$-in. diameter holes of the indicating tubes, as well as the 4 small pins which mold the connecting holes between these tubes and the piping of the instrument, are all withdrawn automatically by cam action in the mold. Since it would be very poor molding technique to attempt to mold the threads shown in the drawing, all threaded sections are tapped after molding.

The indicating pellets shown mounted in the indicating tubes are molded in a single-cavity mold. These small pellets, open at one end (Fig. 1) have a wall section of .005 in., and the molder states that at no time has he ever heard of a whole section being injection molded with so thin a wall section. In order to meet the exacting color specifications, these pellets were molded of polystryene, and the coloring applied later. Two different colors were used, red and green. This coloring proposition brought up one of the minor problems in the completion of the job. The molder states that a special method of coloring the pellets had to be developed in order to make them bright red and bright green. His description of this process is roughly as follows:

The small molded pellets were dropped into jigs which protected their entire outside surfaces. Then the air above the pellets was loaded with a fine haze of the coloring matter. As this settled on the jig, it (*Please turn to page 148*)

DRAWING COURTESY DRUVER MFG. CO.

2



1—This vertical speed indicator is assembled from 4 separate plastic parts: the indicator body (left), 2 indicating pellets mounted in tubes in the indicator body, and the housing (right). 2—This drawing of the indicator body shows clearly the 2 tapering tubes which are molded as integral parts of the body, and the 4 molded-in holes

Via Air . . .

IDENTIFICATION lamps for military supplies dropped by parachute at night are molded of Tenite. Various colors of transparent Tenite lens caps designate the packages containing weapons, provisions, and first-aid supplies.

Tenite is so tough that these lamps withstand bumpy landings without shattering. In rain or snow, they remain lighted. Circuit failure from dampness is prevented by tight-fitting molded Tenite.

Tenite has invaded the aviation industry to produce many lightweight products of exceptional strength. Typical of these are ammunition rollers, bomber visors, instrument dials, dehydrator plugs, hinges for chart cases, and glider inspection hole covers. The use and distribution of Tenite are at present controlled by General Preference Order M-154 and Supplementary Allocation Order M-326-a. TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

Lamps molded by Standard Molding Corp. and Erie Resistor Corp. for Standard Aircraft Products, Inc., and Peerless Manufacturing Co., respectively.

TENITE REPRESENTATIVES

New York, 10 East 40th Street. *Buffalo*, 1508 Rand Building. *Chicago*, 1564 Builders' Building. *Dayton, Ohio*, 305 Third National Building. *Detroit*, 904-5 Stephenson Bldg. *Leominster, Massachusetts*, 39 Main St. *Washington, D. C.*, 1125 Earle Bldg. . . . *Pacific Coast:* Wilson & Geo. Meyer & Company—*San Francisco*, 15th Floor, 333 Montgomery St., *Los Angeles*, 2461 Hunter St.; *Seattle*, 1020 4th Ave., South.



TENITE

an Eastman Plastic



- - and MOSINEE made it!

Your paper problem is not apt to be identical to that of even your most direct competitor . . . Although you both may be aiming at the same end-result, there probably is a difference in procedure or equipment . . . and for such differences you may need a specially engineered paper . . . it might speed production, or improve your product, or both!

Mosinee paper technicians are alert to such situations. When given opportunity to know what paper properties you require, and what your production set-up demands, the Mills of Mosinee adjust *their* processes to meet *your* paper requirements.

With information like the above, we can go to work immediately. What properties or characteristics are needed for your paper?

Please address your letter "Attention Dept. A"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Toughness of molding materials

by THOMAS HAZEN[1]

THE problem of relating the impact strength, toughness and shock resistance of plastic molding materials to the more fundamental mechanical properties, such as the flexural strength and modulus of elasticity as determined by static bending, is considered in this article. At present, the principal tests used to determine the toughness of molding materials are the Charpy and Izod impact strength tests,[2] both of which are standard A.S.T.M. methods. In addition to these, there are in use numerous special tests, both single-blow and repeated-blow types of impact tests, that have been devised for testing finished molded articles such as heater plugs and telephone handsets. In the final analysis, of course, the real measure of the shock resistance of a given material is the record of its performance in actual use in molded parts in service. Unfortunately, it is not generally possible to obtain complete and systematic data on the service performance of molded parts.

Limitations of standard impact tests

When attempts are made to classify materials as to their relative toughness, using, for example, Izod impact strength values, numerous inconsistencies are encountered. For instance, the Izod test indicates that certain phenolic mineral-filled molding materials have a toughness rating equal to or higher than that of phenolic cellulose-filled, general-purpose materials. Both experience and common sense definitely and emphatically contradict such a conclusion. Perhaps the chief difficulty with the present impact tests is that the so-called "energy to break" as read from an impact testing machine is improperly interpreted, for it is obvious that such values include, in addition to the energy actually absorbed by the test specimen, energy that is absorbed by the machine itself and energy that appears as the kinetic energy of the broken end of the test piece after the impact. The so-called "energy to break" would be more accurately characterized by calling it the energy lost by the pendulum or striker in breaking the specimen.

In order to take care of the problem of the kinetic energy imparted to the free end of the broken test specimen after impact, some attempts have been made to correct impact strength data for differences in the specific gravities of the materials being compared. Such a correction would serve a very useful purpose, for this source of error in the Izod test in particular is much more important than is generally realized. There are, however, obvious difficulties involved in applying such a correction except in a qualitative way.

[1] Bakelite Corporation.
[2] A.S.T.M. Designation D256.

Another important aspect of the impact testing of materials is that relating to the influence of the elastic properties of the specimens. The impact machine itself has an effective elastic coefficient (analogous to the force constant of a spring) which is determined by the nature of the clamping device, pendulum, etc., and upon the type of base on which the machine is mounted. The elastic coefficient of the test specimen is proportional to the modulus of elasticity of the material and depends upon the dimensions and shape of the specimen. It can be demonstrated very simply that, in general, in an impact test, the total energy lost by the pendulum will tend to be shared by the specimen and machined in inverse ratio to their respective elastic coefficients. This means that, regarding the elastic coefficient of the machine as a constant, the machine itself will tend to absorb a greater proportion of the total absorbed energy the greater the modulus of elasticity of the material under test. It is not inconceivable that there might be instances in which the energy absorbed by the machine would be comparable to or even greater than that absorbed by the specimen itself.

It is apparent from the above that the absurdly high impact values obtained for phenolic mineral-filled molding materials, and for ceramic materials such as low-loss steatite and porcelain are contributed to by two fundamental properties of these materials—viz., their high specific gravities and their high moduli of elasticity. As will be pointed out below, the toughness of a material—that is, its ability to absorb energy when deformed under load, whether statically or dynamically applied—is inversely proportional to the modulus of elasticity, whereas this property of a material tends to affect the result of an Izod or Charpy impact test in precisely the reverse manner.

The preceding remarks are intended to point out that extreme care must be exercised in interpreting the results of standard impact tests, and not to imply that the impact test has no value. The criticisms that can be made of the results of impact tests are traceable to the prevalent tendency to regard the test as an extremely simple one and, indeed, the apparent simplicity of the machines themselves has undoubtedly contributed to this tendency. It is certain, however, that the results of impact tests alone cannot be depended upon to evaluate correctly the relative toughness characteristics of widely different types of materials.

Static bending tests applied to study of toughness

An excellent means of approaching the study of the toughness of materials is afforded by the standard flexural test. Growing out of some earlier tests begun in 1934 by the writer,

a large accumulation of data has been made from flexural tests performed to obtain load-deflection curves for molding materials. It is worth noting that studies of this kind can be carried out in connection with the more or less routine mechanical strength testing of materials and hence do not in general require the molding of special test specimens or the use of special testing equipment. The data obtained from these tests have given emphasis to the fact that, with relatively few exceptions, the complete load-deflection diagrams for phenolics, for certain other types of molding plastics and particularly for ceramic materials, are straight lines or close approximations of straight lines. In other words, the great majority of phenolic plastic molding materials and many other related materials show either no appreciable deviation or only relatively slight deviation from Hooke's law for all values of applied load up to the breaking point.

Since the concept of toughness is associated with the amount of mechanical energy a material can absorb before fracture when deformed under an applied load, an arbitrary definition of the toughness of plastic molding materials and the like has been adopted. This is based on the total energy expended in deforming a standard 5 × 1/2 × 1/2-in. flexural bar from zero load to the point of rupture by static bending. In general, the total work done in a bending test is measured by the area under the complete load-deflection diagram (Fig. 1).

Since the form of the function relating the applied load to the corresponding central deflection of the test bar for the general case of bending will not be known—except for loads within the elastic limit—some type of mechanical integration, such as may be performed with a planimeter, is necessary to obtain the area under the load-deflection diagram, and hence the total breaking energy or work of rupture. It is obvious, however, for the case in which the load-deflection diagram is completely linear, that the total breaking energy, E, can be expressed in terms of ultimate flexural strength, F, and the modulus of elasticity, M, as follows:

$$E = F^2Lbd/18M$$

where L is the length of the test bar between supports and b and d are the breadth and depth, respectively, of the test bar (Fig. 1).

If the toughness be arbitrarily defined as the mean energy density within the volume Lbd of the stressed part of the bar at the ultimate breaking load, the toughness in ft.-lb. per cu. in. will be given by the following formula, when F and M are expressed in lb. per sq. inch:

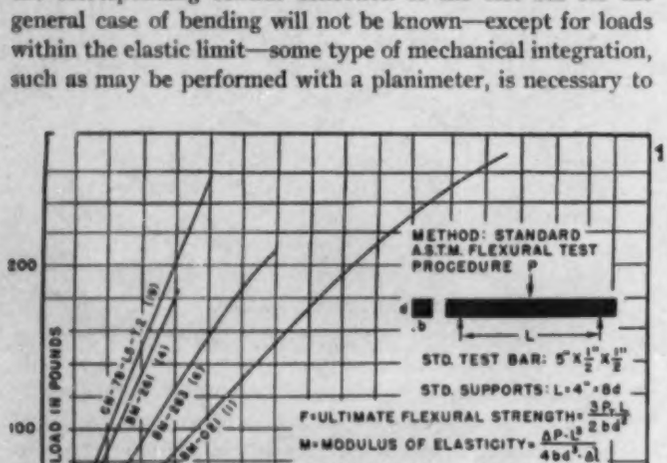
$$\text{Toughness} = E/Lbd = .00463\ F^2/M.$$

The value so calculated will be numerically equal to the energy in ft.-lb. required to break a standard 5 × 1/2 × 1/2-in. flexural bar by static bending on 4-in. supports, since the volume of the stressed part of the standard bar is one cu. inch. It must be remembered that the foregoing formula is strictly true only for cases in which the load-deflection diagrams are completely linear; but it is approximately correct for a large number of materials whose load-deflection diagrams do not deviate very greatly from complete linearity. In other instances the total energy of rupture can be obtained only by mechanical integration of the area under the load-deflection curve.

The general relationship expressed by the above formula shows that, in general, for most phenolic molding plastics, attempts to increase the toughness should be aimed primarily at increased ultimate strength characteristics, since the toughness is proportional to the second power of the flexural strength. But a lowering of the modulus of elasticity will also tend to increase the toughness, which is shown to be in inverse ratio to only the first power of the modulus of elasticity. In general, it would not be desirable to attempt to reduce the modulus of elasticity too much, as this can be accomplished obviously only at the expense of a sacrifice of rigidity in molded parts.

Relation of bending tests to standard impact tests

Toughness, as defined in terms of the energy expended on unit volume of a material in a bending test, i.e., in terms of the mean energy density throughout the stressed part of the standard flexural bar at the ultimate breaking load—this energy, in general, consisting of the elastic strain energy, plus any energy absorbed in plastic deformation or the like beyond the elastic limit and being estimated by integration of the area under the load-deflection diagram by use of a planimeter or otherwise—is certainly related to the tough-



DISCUSSION

I. IN GENERAL THE ENERGY EXPENDED IN BREAKING THE SPECIMEN MAY BE REPRESENTED BY THE AREA UNDER THE LOAD-DEFLECTION DIAGRAM, OR

$$E = \int_0^{l_r} P\,dl = \int_0^{l_r} \phi(l)\,dl$$

WHEN $P = \phi(l)$ IS UNKNOWN, A PLANIMETER MAY BE USED TO DETERMINE THE AREA UNDER THE LOAD-DEFLECTION DIAGRAM.

II. IN THE CASE OF COMPLETE LINEARITY OF THE LOAD-DEFLECTION DIAGRAM, $P = K \cdot l$, AND:

(1) $E = \int_0^{l_r} K \cdot l \cdot dl = \frac{1}{2} K \cdot l_r^2 = \frac{1}{2} P_r \cdot l_r$

(2) $F = \frac{3P_rL}{2bd^2}$; $M = \frac{P_rL^3}{4bd^3 l_r}$

(3) $\therefore P = \frac{2Fbd^2}{3L}$, AND $l_r = \frac{P_rL^3}{4bd^3M} = \frac{FL^2}{6Md}$

FROM (1) WE HAVE: ENERGY TO BREAK = $E = \frac{1}{2} P_r l_r$; HENCE,

(4) $E = \frac{F^2Lbd}{18M} = \frac{F^2V}{18M}$

(5) "TOUGHNESS" OF MATERIAL = $\frac{E}{V} = \frac{F^2}{18M}$

1—Typical load-deflection diagrams for phenolic M/M's. Discussion suggests possibility of at least a qualitative relationship between fundamental mechanical constants and impact strength, toughness or shock resistance. 2—Load-deflection diagrams obtained from static bending tests on standard A.S.T.M. 5-in. × 1/2-in × 1/2-in. flexural bars of different types of materials. 3—Typical load-deflection diagrams obtained from static bending tests on standard A.S.T.M. flexural bars. 4—Relative "toughness" of various materials as indicated by Izod impact tests (shown at top). Relative "toughness" of various materials as indicated by standard flexural tests (shown at bottom)

ness as indicated by standard Charpy or Izod impact strength tests. One fundamental difference between the two types of tests lies in the time rate of loading. The time that elapses in an impact test is of the order of small fractions of a second, whereas in these static bending tests it is of the order of a minute or so. The effect of the rate of loading is undoubtedly very important for some materials and perhaps quite unimportant or even negligible for others.

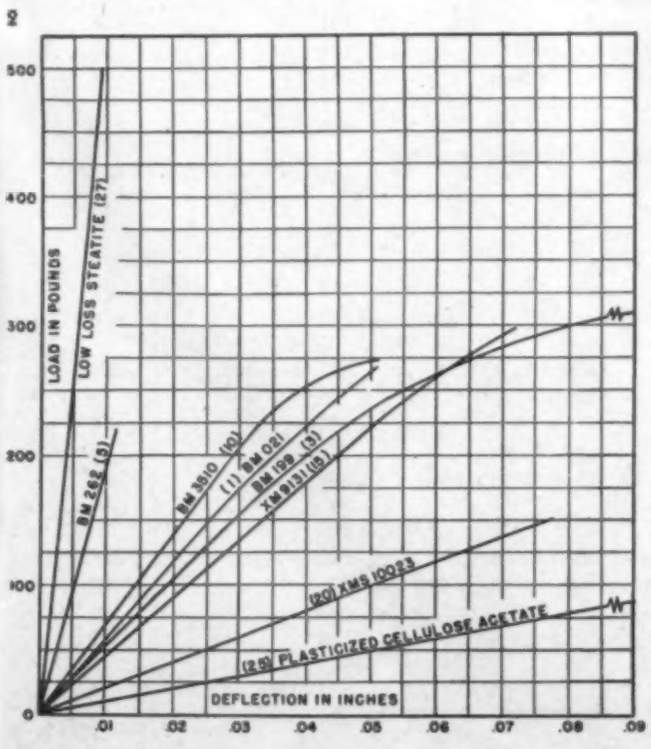
Another difference, particularly important for the phenolic fabric-base fibrous materials, is in the nature of the fracture produced by the two types of test. For the materials just mentioned, the flexural test must of necessity be stopped at the first appearance of fracture, whereas in the impact test the broken end of the test specimen is nearly always completely torn away, with the consequent expenditure of an additional amount of energy. It is this difference, undoubtedly, that tends to make the static bending test appear to underrate the toughness of special high-impact materials with fabric fillers, though there seems to be considerable reason to believe that there is also a tendency for the Izod test to overrate the same materials.

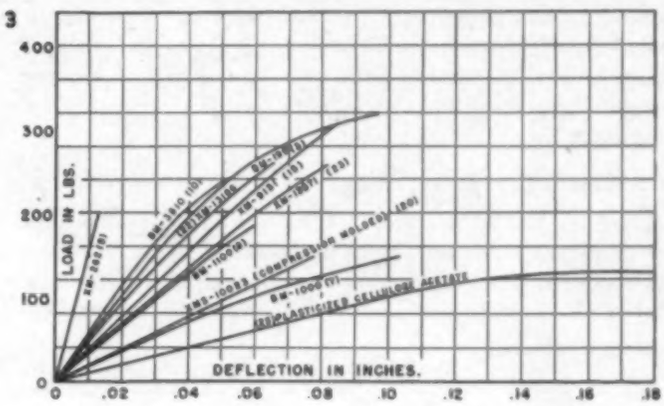
Other factors influencing the results of toughness determinations by the two types of tests relate to notched as against unnotched specimens, to the characteristics of some materials such as creep, cold flow and elastic fatigue, and to clamping and the like. Flexural tests on notched specimens could help to clarify some of these factors. The others are beyond the intended scope of this present discussion, but they are indicative of a few of the numerous lines of investigation along which further work could be carried on with the expectation of profitable results.

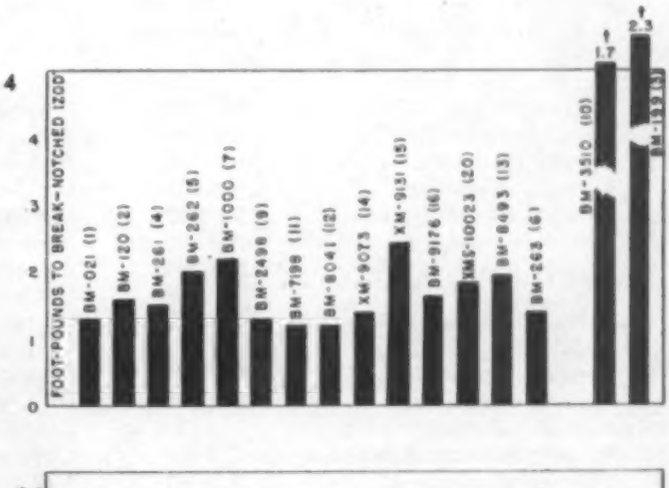
Significance of load-deflection diagrams

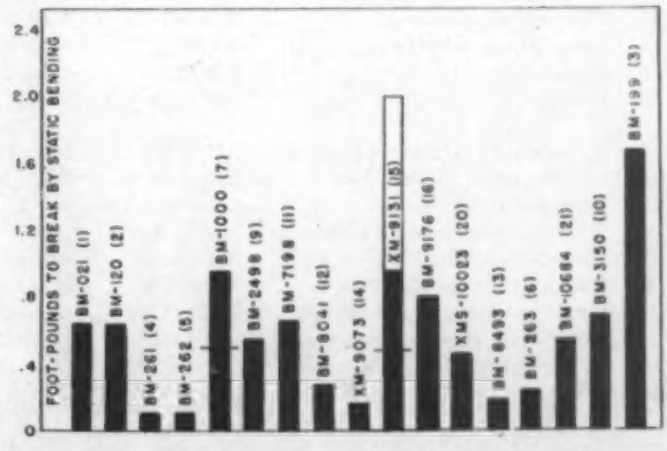
In Figs. 1, 2 and 3, typical load-deflection diagrams for various materials are shown. These diagrams are important in themselves as a means of facilitating the study of the elastic and ultimate strength characteristics of materials. Since the slopes of the load-deflection diagrams, in these portions within the elastic limits, are proportional to the moduli of elasticity, the curves make it very easy to visualize the practical significance of a high or low modulus of elasticity. In Fig. 4, the "toughness" ratings of a number of typical molding materials are summarized in graphical form.

In presenting these diagrams, the aim has been to include materials possessing as widely different characteristics as possible. Thus, the materials vary from the highly flexible type, such as plasticized cellulose acetate, which had an apparent modulus of elasticity of about 0.26×10^6 p.s.i., through the intermediate types like modified phenolic cellulose-filled molding material, compression-molded polystyrene and the phenolic cellulose-filled materials, to the phenolic mineral-filled materials, which have relatively high moduli of elasticity of the order of 3.0 to 5.0×10^6 p.s.i. Also, as a matter of interest, the low-loss steatite material has been included. Its modulus of elasticity, about 15×10^6 p.s.i., is approximately four times that of phenolic low-loss mineral-filled molding material, and its flexural strength of 24,000 p.s.i. is more than twice that of the average run of phenolic low-loss mineral-filled molding material. It is worthy of note









at this point that, though Charpy impact tests give rather high values for low-loss steatite, the toughness of this material as determined from bending tests by the method outlined in preceding paragraphs is only slightly higher than that of the phenolic low-loss mineral-filled molding material as determined by the same means. The high specific gravities and high moduli of elasticity of these two materials both tend to contribute to the indication of falsely high impact strength values by standard impact tests, for the reasons stated earlier.

The term "brittleness" as used in engineering frequently has a connotation somewhat different from that of the everyday usage of the word. In engineering, the term may be used to describe the degree of straightness or linearity of the load-deflection diagram for a material, and may have no reference to the absolute values of either the ultimate strength or modulus of elasticity. Thus, phenolic low-loss mineral-filled molding material, low-loss steatite and compression-molded polystyrene are all examples of almost perfectly "brittle" materials, though they differ widely in both strength and flexibility. The toughness of compression-molded polystyrene is considerably greater than that of either phenolic low-loss mineral-filled molding material or low-loss steatite because of the relatively low modulus of elasticity of polystyrene.

Comparative toughness ratings

In Fig. 4, the relative "toughness" ratings of various standard materials are shown by means of block diagrams, first, as based on notched-bar Izod impact strength data taken for the most part from standard property sheets and, second, as based on the total work of rupture obtained from static bending tests performed on standard A.S.T.M. flexural bars. The discrepancy between the two methods of rating the materials in question is at once apparent and, if a few of the special materials are excepted, the second method appears to rate the materials in a manner far more consistent with actual experience and common sense than does the first method. It should be pointed out that the values shown by both methods are subject to certain batch-to-batch variations, but that for the most part they may be regarded as typical and of the proper orders of magnitude for the plastic molding materials in question. A few materials, like transparent phenolic molding material, and modified phenolic cellulose-filled molding material, are particularly subject to wide variations in strength, and an attempt has been made to indicate this fact on the block diagrams of Fig. 4.

A summary of the data used in preparing the block diagrams in Fig. 4 is given in Table I. These values are believed to be as nearly representative as it is possible to obtain, although, of course, they are subject to variations depending upon molding conditions and other factors. It must be borne in mind, in studying this table, that the relative ratings of the materials by the two methods of test are the things being compared and not the absolute values, which would not be expected to be comparable. The same applies also to Fig. 4. This discussion would not be complete without some comments calling particular attention to certain materials in the foregoing table which have a special interest from the standpoint of the results obtained in static bending tests. With regard to the phenolic fabric-base high-impact materials, mention has already (*Please turn to page 144*)

TABLE I.—COMPARISON OF STATIC BENDING AND IZOD IMPACT TEST DATA

	Material	*Bakelite designation*	*Type*	*Energy to break standard flexural bars by static bending*	*Standard notched bar Izod impact strength*
				ft.-lb.	*ft.-lb.*
1.	Phenolic cellulose-filled	BM 021	General-purpose	.632	.13
2.	Phenolic cellulose-filled	BM 120	General-purpose	.629	.16
3.	Phenolic fabric-base	BM 199	High impact resistance	1.68	2.3
4.	Phenolic mineral-filled	BM 261	High heat resistance	.101	.15
5.	Phenolic mineral-filled	BM 262	Low-loss radio insulation	.101	.20
6.	Phenolic mineral-cellulose-filled	BM 263	Medium-high heat resistance	.241	.14
7.	Phenolic (modified) cellulose-filled	BM 1000	Arc-resistant magneto insulation	.951 (variable)	.22
8.	Phenolic (modified) cellulose-filled	BM 1100	General-purpose for molding around inserts	.487	...
9.	Phenolic cellulose-filled	BM 2498	General-purpose	.548	.13
10.	Phenolic fabric-base	BM 3510	High impact resistance	.691	1.7
11.	Phenolic cellulose-filled	BM 7198	General-purpose	.651	.12
12.	Phenolic mineral-cellulose-filled	BM 8041	Chemical resistance	.271	.12
13.	Phenolic mineral-filled	BM 8493	Moisture resistance	.178	.19
14.	Phenolic mineral-filled	XM 9073	High heat resistance	.165	.14
15.	Phenolic—no filler	XM 9131	Transparent, water resistance	.945 (variable)	.24
16.	Phenolic cellulose-filled	BM 9176	Special-purpose, impact resistance	.803	.17
17.	Phenolic mineral-filled (not baked)	BM 9928	Medium-high heat resistance	.231	.16
18.	Phenolic mineral-filled (baked)	BM 9928	Medium-high heat resistance	.380	...
19.	Phenolic mineral-filled	CN-78-L5-T.2	.....	.24	.15
20.	Polystyrene (compression-molded)	XMS 10023	.....	.453	.18
21.	Phenolic cellulose-filled	BM 10684	Special-purpose, for closures	.542	...
22.	Phenolic cellulose-filled	XM 13186	General-purpose	.712	.20
23.	Phenolic (modified) cellulose-filled	XM 13571	Special-purpose	.838	.20
24.	Phenolic (modified) cellulose-filled	BM 14316	General-purpose	.813	.20
25.	Plasticized cellulose acetate	.....	.....	2.20	...
26.	Acrylic resin	.....	.....	.685	.22
27.	Low-loss steatite	.....	.....	.185	...

Evaluation of high-strength plastics

by HENRY SANG and PHILIP M. FIELD*

THE experimental work reported in this paper was undertaken to make a preliminary determination of the physical properties of high-strength plastics that show promise for use in aircraft structures. All thermoplastic resins known at the present time are heat unstable and possess a low modulus of elasticity (100,000 to 600,000). The investigation was restricted, therefore, to plastics incorporating thermosetting resins. These resins usually have a higher modulus of elasticity (700,000 to 1,000,000) and are relatively heat stable.

The high-strength plastics derive the greater part of their strength from the reinforcing material. The strongest commercial plastics are the laminates, typical properties of which are listed in Table III. Recently, manufacturers have made laminates incorporating exceptionally strong reinforcing materials such as special paper and glass-fiber fabric. This report lists the properties of these special laminates.

It is emphasized that high-strength plastics are a new development. Substantial improvements in properties may be expected. Different or improved resins are likely to be employed. The tests reported herein cover only certain of the basic properties. Tests to determine other properties such as shear, resistance to repeated stress and effect of extreme service temperatures are under way.[2]

In the case of materials showing definite promise, such as the paper- and glass-reinforced laminates, it is planned to conduct tests of basic structural test specimens. At the same time, semi-structural aircraft parts molded from these materials are being procured to determine the possibilities from the manufacturing standpoint. Instrument panels of high-strength plastic have already been static tested and service tests have been recommended. High-strength plastic tubing, both round and streamlined, is being tested.

[1] Based on report No. AMS(S)-629, Aeronautical Materials Laboratories, Engineering Division, Naval Aircraft Factory.

[*] Naval Aircraft Factory.

[2] The results of these tests were reported in the paper by P. M. Field entitled "Basic Physical Properties of Laminates," published in MODERN PLASTICS *20*, 91–102, 126, 128, 130 (Aug. 1943).

Description of materials

The high-strength materials under consideration consist, with one exception, of paper or glass-and-cotton fabric, laminated with a phenol-formaldehyde or melamine resin. The exception is a material which consists of a felted asbestos-fiber base impregnated with phenol-formaldehyde resin.

The materials designated as B-7, F-8, F-13, FP-15 and MC-

TABLE I.—COMPARISON BETWEEN PLASTICS AND ALUMINUM ALLOY 24 ST[1]

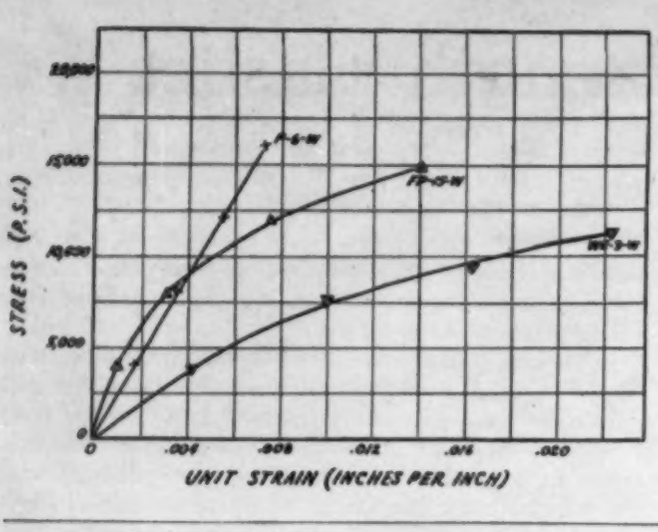
Material	*N.A.F. designation*	E[2]	σ_{cys}[2]	ρ	*Weight saving—[3] critical buckling of flat plate*	*Weight saving—[3] critical buckling of curved sheet*	*Weight saving—[3] ultimate buckling of flat plate*
		10^6 p.s.i.	*p.s.i.*	*lb./in.^{3}*	%	%	%
Phenolic resin; glass fabric and cotton (alternate laminations) base, crossbanded	F-6	2.243	15,700	.0593	+1.4	−26.0	−8.3
Phenolic resin; spruce sulfite paper base, crossbanded	FP-15	1.65	11,550	.0501	+7.8	−24.2	−7.0

[1] Definitions and formulas can be found in the Bureau of Aeronautics Structures Memorandum No. 7, "A Method of Determining the Structural Efficiency of New Materials," (Aug. 15, 1942).
[2] Values of E and σ_{cys} each represent the maximum of four tests.
[3] In the weight saving columns a positive value represents a weight saving; a negative value represents a weight increase.

TABLE II.—TENSILE PROPERTIES OF VARIOUS PLASTICS AT HIGH TEMPERATURES[4]

N.A.F. designation		*Room temperature*			*High temperature (160° F.)*			*Properties at 160° F. expressed as % of corresponding properties at room temperature*		
		Ultimate strength	*Yield strength*	*Secant modulus*	*Ultimate strength*	*Yield strength*	*Secant modulus*	*Ultimate strength*	*Yield strength*	*Secant modulus*
		p.s.i.	*p.s.i.*	*10^6 p.s.i.*	*p.s.i.*	*p.s.i.*	*10^6 p.s.i.*	*p.s.i.*	*p.s.i.*	*10^6 p.s.i.*
F-6	W	37,900	14,300	2.05	29,900	14,200	2.03	78.9	99.3	99.0
	C	33,600	13,500	1.92	27,700	13,400	1.92	82.4	99.2	100.0
FP-15	W	20,700	11,300	1.61	12,000	5,950	.850	58.0	52.6	52.8
	C	20,100	11,600	1.65	11,700	6,260	.894	58.1	54.0	54.1
F-13	W	27,600	16,800	2.40	18,500	11,600	1.655	67.0	69.0	69.0
	C	26,400	17,000	2.43	18,300	12,300	1.76	69.3	72.4	72.4
RI-4	W	19,700	8,540	1.22	14,900	6,500	.928	75.5	76.1	76.0
	C	11,900	5,740	.820	11,000	4,200	.600	92.4	73.2	73.2

[4] Further information concerning composition of materials and definition of properties may be found in Table I. RI-4 is similar to commercial grade "L" (linen-reinforced phenolic).



1—*Typical stress-strain curves, compression test*

1 were reinforced with Mitscherlick spruce sulfite paper. They were low-pressure molded (75–250 p.s.i.). All other samples were high-pressure molded. The phenol-formaldehyde and melamine resins were cured at upward of 275° F. All the specimens which were tested were cut from flat sheets molded in a press.

Test methods and results

All tests were conducted in accordance with the revised Naval Aircraft Factory Test Manual. For all tests mentioned in this report the Naval Aircraft Factory Test Manual agrees with Federal Specification L-P-406 entitled "Plastics, Organic; General Specification (Methods of Tests)." The bearing test pin is $^1/_8$ in. instead of $^1/_4$ in. in diameter, as al-

TABLE III.—PHYSICAL PROPERTIES OF HIGH-STRENGTH PLASTICS[a]

N.A.F. designation[b]	Manufacturer designation	Filler	Bending: Average thickness[c]	Bending: Specific gravity	Bending: Modulus of rupture[d]	Bending: Specific modulus of rupture[e]	Bending: Modulus of elasticity	Bending: Specific modulus of elasticity[e]	Tension: Ultimate strength	Tension: Specific ultimate strength
			in.		p.s.i.	p.s.i.	10^6 p.s.i.	10^6 p.s.i.	p.s.i.	p.s.i.
ALUMINUM ALLOYS										
24 ST	.....	.....	..	2.8	62,000	7,900	10.30	.469	62,000	22,100
COMMERCIAL LAMINATES										
DA-3W	.....	Paper	.189	1.48	21,700	9,900	1.72	.531	13,300	9,000
DA-3C	.....	Paper	..	...	18,900	8,630	1.55	.478	20,000	13,500
DA-7W	.....	Paper	.130	1.355	18,600	10,100	1.05	.425	15,600	11,500
DA-7C	.....	Paper	..	...	15,900	8,710	.915	.369	12,400	9,160
WE-3W	NEMA GR. "C"	Cotton fabric	.138	1.39	19,500	10,100	.707	.261	13,600	9,800
WE-3C	NEMA GR. "C"	Cotton fabric	..	...	19,100	9,950	.670	.248	8,800	6,330
HIGH-STRENGTH MATERIALS										
B-7W	.....	Spruce sulfite paper	.121	1.355	28,100	15,300	2.20	.886	25,800	18,900
B-7C	.....	Spruce sulfite paper	..	...	21,200	11,600	1.06	.567	16,100	11,900
FP-15W	MR-1880	Spruce sulfite paper (cross-laminated)	.131	1.324	22,400	12,700	1.36	.586	20,700	15,700
FP-15C	MR-1880	Spruce sulfite paper (cross-laminated)	..	...	21,300	12,100	1.32	.569	20,100	15,200
FP-16W	MR-1880	Spruce sulfite paper (parallel laminated)	.140	1.37	28,100	14,900	1.86	.726	28,700	21,000
FP-16C	MR-1880	Spruce sulfite paper (parallel laminated)	..	...	18,000	9,600	.964	.376	14,200	10,400
F-8W	X-76	Spruce sulfite paper (parallel laminated)	.135	1.41	33,900	17,000	2.20	.750	31,900	22,600
F-8C	X-76	Spruce sulfite paper (parallel laminated)	..	...	26,100	13,100	1.46	.543	23,000	16,300
F-13W	.....	Spruce sulfite paper (cross-laminated)	.121	1.39	29,400	15,200	1.83	.680	27,600	19,800
F-13C	.....	Spruce sulfite paper (cross-laminated)	..	...	29,800	15,400	1.78	.662	26,400	19,000
MC-1W	.....	Spruce sulfite paper	.128	1.38	25,700	13,500	1.38	.525	25,000	18,100
MC-1C	.....	Spruce sulfite paper	..	...	27,400	14,400	1.76	.669	25,900	18,900
F-6W	FF-76	Glass fabric and cotton (alternate laminated)	.145	1.68	35,600	12,600	2.64	.560	37,900	22,600
F-6C	FF-76	Glass fabric and cotton (alternate laminated)	..	...	....	....	..	..	33,600	20,000
RI-18W	T-698	Asbestos fibers	.110	1.63	25,100	9,450	1.84	.424	19,200	11,700
RI-18C	T-698	Asbestos fibers	..	...	22,400	8,420	1.51	.348	15,000	9,220

[a] The majority of the values in the table represent the average of 2 duplicate specimens. All materials were bonded with phenol-formaldehyde resin except DA-3 which was bonded with melamine-formaldehyde resin.
[b] "W" signifies "with grain" (or in one arbitrary direction), and "C" signifies "cross grain" (or in a perpendicular direction).
[c] Average thickness is for all specimens except compression, which were $^1/_2$ in. thick.
[d] Modulus of rupture in bending (M): $M = \frac{3Pl}{2bd^2}$, where P = ultimate load in bending; l = span of simply supported beam; b = width of specimen; d = thickness of specimen.
[e] Specific modulus of rupture: $\frac{M}{S}$, where S = specific gravity.

lowed in paragraph B-5e of that specification. The test data are listed in Table III. Data for aluminum alloy and commercial laminates are included for comparison.

Conclusions

A comprehensive evaluation of the various materials is not believed justified until further test work has been completed. However, the following points of interest are to be noted:

a. The specific flexural values compare favorably with those of aluminum alloy.

b. The specific tensile strength of the paper and glass-and-cotton materials approaches that of aluminum alloy.

c. The specific bearing strength is low compared with that of aluminum alloy.

d. The specific compressive strength is much lower than that of aluminum alloy.

e. The tensile and compressive yield strengths are, in general, a lower percentage of the ultimates than in aluminum alloy. Typical values are shown in Table IV.

f. Table I gives a comparison of (*Please turn to page 142*)

TABLE IV.—TYPICAL RELATIONSHIPS OF YIELD STRENGTHS TO ULTIMATE STRENGTHS

Material	*In tension*	*In compression*
	%	%
Aluminum alloy 24 ST	64.5	64.5
F-6—Glass fibers	39.0	65.2
F-13—Paper	62.6	55.0

TABLE III.—(*Continued*)

Tension				*Compression*					*Bearing*		*Water Absorption*				
Yield strength	*Specific yield strength*[b]	*Secant modulus*	*Elongation*	*Ultimate strength*	*Specific ultimate strength*[b]	*Yield strength*	*Specific yield strength*[b]	*Secant modulus*	*Bearing strength*	*Specific bearing strength*[b]	*Water absorption*	*Dimensional stability; change in:*			*Warpage*[c]
												Length	*Width*	*Thickness*	
		10^6						10^6							
p.s.i.	*p.s.i.*	*p.s.i.*	%	*p.s.i.*	*p.s.i.*	*p.s.i.*	*p.s.i.*	*p.s.i.*	*p.s.i.*	*p.s.i.*	%	%	%	%	*in.*
40,000	14,300	6.67	17.5	62,000	22,100	40,000	14,300	6.67	89,600	32,000	..	..	..	..	...
40,100	6,840	1.81	0.0	....	....	....	....	...	....	....	..	..	..	..	...
15,100	10,200	2.59	0.5	....	....	....	....	...	....	....	..	..	..	..	...
9,140	6,740	1.31	1.0	....	....	....	....	...	....	....	..	..	..	..	...
8,010	5,910	1.14	0.0	....	....	....	....	...	....	....	..	..	..	..	...
7,190	5,170	1.021	2.5	24,500	17,600	5,410	3,900	.773	17,900	12,900	..	..	..	..	...
5,990	4,300	.856	2.7	19,400	14,000	5,710	4,110	.815	18,300	13,200	..	..	..	..	..
15,000	11,100	2.14	1.0	....	....	....	....	...	24,300	17,900	4.78	0.00	0.09	3.35	.0059
8,800	6,500	1.26	1.2	....	....	....	....	...	22,800	16,900	..	..	..	..	...
11,300	8,550	1.61	1.0	19,700	14,900	10,900	8,250	1.56	15,000	11,300	5.78	0.00	0.00	3.14	.0133
11,600	8,770	1.65	0.7	19,400	14,600	10,500	7,950	1.50	16,700	12,600	..	..	..	..	...
16,800	12,300	2.40	1.0	....	....	....	....	...	22,800	16,600	6.64	0.00	0.10	4.94	.0144
7,760	5,680	1.11	2.0	....	....	....	....	...	19,800	14,400	..	..	..	..	...
18,800	13,300	2.68	0.0	....	....	....	....	...	29,800	21,200	1.58	0.00	0.40	1.53	.0043
11,600	8,240	1.66	0.0	....	....	....	....	...	29,700	21,000	..	..	..	..	...
16,800	12,100	2.40	0.2	....	....	....	....	...	32,900	23,700	1.20	0.00	0.13	1.39	.0023
17,000	12,200	2.43	0.5	....	....	....	....	...	33,000	23,700	..	..	..	..	...
13,400	9,720	1.91	0.2	....	....	....	....	...	28,600	20,700	..	..	..	..	...
15,700	11,400	2.25	0.5	....	....	....	....	...	26,900	19,500	..	..	..	..	...
14,300	8,520	2.05	0.5	22,600	13,500	14,900	8,890	2.12	....	....	1.03	0.00	0.09	0.70	.0010
13,500	8,050	1.92	1.0	24,000	14,300	15,500	9,240	2.21	....	....	..	..	..	..	...
12,400	7,610	1.78	0.7	....	....	....	....	...	....	....	..	..	..	..	...
10,300	6,330	1.47	0.7	....	....	....	....	...	....	....	..	..	..	..	...

[a] Modulus of elasticity (E): $E = \frac{P_1 l^3}{4bd^3y}$, where P_1 = applied load when maximum fiber stress equals 76 percent of M; y = corresponding deflection at center of beam.

[b] Specific modulus of elasticity = $\frac{E}{S^i}$.

[b] Specific strength = $\frac{\text{absolute strength}}{S}$.

[c] Warpage was measured as described under Accelerated Exposure Test in revised Naval Aircraft Factory Test Manual, except that 3-in. × 1-in. specimen was used.

American Chemical Society meeting

THE following abstracts of papers presented before the Division of Paint, Varnish and Plastics Chemistry and other Divisions of the American Chemical Society at Pittsburgh, Pa., on September 6 to 10, indicate a few of the many phases of research on the chemistry and engineering of plastics which are currently under way in this country.

MONOCYCLIC TERPENE-MALEIC ANHYDRIDE ADDITION PRODUCTS AND THEIR ESTERS. Elwood H. Ensor and J. G. Little, Hercules Powder Co.

Monocyclic terpene hydrocarbons containing nonconjugated double bonds react with maleic anhydride at elevated temperatures. If small amounts of mineral or organic acids are present, these nonconjugated double bonds isomerize to a conjugated system and a normal Diels-Alder addition takes place. In the absence of free acids, reaction takes place with the nonconjugated hydrocarbons to give 2 types of products: (1) a monomeric addition product formed by a hydrogen displacement reaction, and (2) an interpolymer of the terpene and maleic anhydride. The structures of the polyesters obtained when a mixture of these monomeric and polymeric addition products is esterified with glycols or glycerol are discussed. The regular gradation of the properties of these polyesters prepared from a series of glycols can be shown to be explainable on a basis of their structural formulas. Similarly the self-plasticization, water dispersibility, other properties of these polyesters can be interpreted by means of their structural formulas. Finally a few of the important applications of these resins are described.

UREA FORMALDEHYDE RESINS IN WATER-THINNED PAINTS. John K. Wise, United States Gypsum Co.

In the preparation of water-thinned wall paints from cold setting urea formaldehyde resins, certain pigments and fillers have been found to inhibit the cure of the resin. This inhibition seems to be a surface phenomenon rather than a chemical reaction between the pigment and the accelerator used. Pigments for use in paints of this type may be evaluated by electrometric titration with ammonium chloride solution.

SALTS OF RESIDUAL DIMERIZED FAT ACIDS. A NEW CLASS OF RESINOUS SUBSTANCES. J. C. Cowan and H. M. Teeter, Northern Regional Research Laboratory.

Certain salts, in particular the zinc, calcium and magnesium salts, of residual dimerized fat acids have been found to possess marked resinous properties, being capable of fiber and film formation and forming viscous solutions. These properties are attributed to ionic associations of divalent anions and cations into long chains. Approximate molecular weight determinations by viscometric methods indicate a value of about 15,000 in 10 percent solutions in pyridine. While fibers apparently are too weak to be of practical use, the film-forming properties have been utilized in the formulation of shellac substitutes and varnish, the latter being compared with zinc resinate and ester gum varnishes.

METHOD FOR DETERMINING PLASTICIZER CONTENT OF CELLULOSE ESTERS. B. S. Biggs and R. H. Erickson, Bell Telephone Laboratories.

Plasticizer content is determined by the vacuum distillation of the plasticizer from the sample. Dry samples of 1 gram or less are placed in weighing bottles on the floor of a special vacuum still, heated with Dowtherm. The sample is quickly converted to a film by action of a solvent and heating is continued for 1.5 hours. The loss in weight is due to plasticizer plus a slight decomposition of the cellulose ester. The latter is determined on a blank but is usually small enough and uniform enough that a fixed value may be assumed for it. Plasticizer content is given within about 0.3 percent.

POLYMER DISTRIBUTION OF VARNISH RESINS. H. E. Adams and P. O. Powers, Armstrong Cork Co.

An estimate of polymer distribution of modified phenolic, maleic and several hydrocarbon resins has been made by nephelometric titration. A dilute solution of the resins is precipitated by gradual addition of a nonsolvent, and the resulting turbidity measured by a photronic cell. The volume of precipitant is a measure of the degree of polymerization and the turbidity is the measure of the amount of resin precipitated. The apparatus is relatively simple and the titration requires only a few minutes.

HEATRONIC MOLDING. V. E. Meharg, Bakelite Corp.

"Heatronic molding" is a coined term which covers the general use of a high frequency current for heating a plastic to forming or molding temperature prior to this operation. Heat is generated uniformly within the material. Factors covering this heat generation are discussed broadly. As applied to plastics, the new process is useful because of uniform heating, developed within the material and at a rapid rate as compared with present conventional conduction methods. The most immediate application is found in the thermosetting type. Here the uniform rapid heating leads to distinct advantages in the molding of such plastics. These may be briefly summarized:

1) Faster molding, particularly in thick sections.
2) Softer plastic flow, requiring less pressure for the molding operation.
3) The possibility of lower cost dies because of lowered pressure.
4) The possibility of molding much larger and heavier pieces than have heretofore been practical.
5) Generally lower cost molded products.

In addition to these benefits, the economics of the process are briefly discussed and shown to be favorable.

SOME FACTORS IN MOLDING OF CELLULOSE DERIVATIVES. W. O. Bracken and F. E. Piech, Hercules Powder Co.

Physical, mechanical and chemical factors involved in conventional methods of molding (injection, hot extrusion and sheeting) are outlined for cellulose derivatives. Critical

temperature areas and balance of temperature in the process are discussed. Higher bake temperatures and controlled solvent content are suggested for cellulose acetate and ethyl cellulose sheeting blocks. The effect of judicious selection of cycle is pointed out. Favoring of high pressures rather than proper temperatures for adequate cycles may lead to deceptive results. Orifices designed for one derivative may not produce the most effective piece with a different derivative. Relationships between degree of molecular substitution and flow characteristics of a cellulosic compound with a molded structure are discussed for cellulose acetate and ethyl cellulose.

PLYWOOD BONDING SCHEDULES. Henry Grinsfelder and Maxwell Collins, Resinous Products & Chemical Co.

The phenomenal and continuing growth in the use of plywood for aircraft and marine construction is distinct evidence of the widespread interest in the more efficient utilization of phenol-formaldehyde resin adhesives. The data in these studies have been directed toward compliance with United States specifications for aircraft plywood with particular reference to shear strength requirements. The objective of this work has been to establish a laboratory method for determining a minimum bonding time schedule which is applicable to a wide variety of plywood constructions and bonding conditions. This objective has been accomplished by making a large number of heat-penetration measurements in plywood of various thicknesses placed between heated platens. In another series of experiments the time necessary to cure the resin adhesive has been established for one particular plywood construction and then mathematically calculated to correct for the difference between platen temperature and actual resin temperature. In this calculation, it was possible to determine the rate of polymerization of the resin adhesive at different temperatures. The reaction rate of the particular resin investigated appears to double with every 28° F. (14.4° C.) rise in temperature.

The bonding time for a particular plywood construction is obtained from the heat-penetration curve and the rate of reaction curve by a modification of the method proposed by Bryant. In this procedure a stepped curve is developed below the actual curve in which the temperature is assumed to remain constant at one temperature for the time necessary actually to increase 10° F. Using the curing time at various temperatures in the midpoint of each step, the proportion or percentage of the total cure attained during each increment is calculated. When the sum of the percentages for the successive steps totals 100 percent, the cure is assumed to be complete. The corresponding time is taken as the minimum permissible bonding time. The pressing times for a number of constructions can be calculated by this method and plotted to represent a generalized bonding schedule.

A COMPARISON OF SEVERAL METHODS FOR IMPROVING WOOD. Henry Grinsfelder, L. Klein and S. D. Bailey, Resinous Products & Chemical Co.

Much interest has been aroused in recent months for improving the physical properties of wood. Predominant among the methods employed has been that one using a phenol-formaldehyde resin as impregnant followed by compression of the wood to attain dimensional stability and improved strength. Other methods, however, may also be used, which include the use of resin film interleaved between veneers, or liquid resin applied to veneers by resin glue spreaders and subsequent application of heat and pressure. Various properties are compared, including dimensional stability under exposure to both water and heat, tensile strength, impact strength, ease of compression, shear strength, modulus of elasticity in bending, modulus of rupture, ease of manufacture, surface appearance and cost. Each process has a superiority when only one or two specific properties are being considered. No process is outstanding in all properties. However, it would appear that the process with the greatest number of superior properties is the film bonding process. Its chief weakness has been lack of dimensional stability but, by the use of higher temperatures and pressures than heretofore considered, improvement can be made in this property.

END GROUP STRUCTURE OF POLYVINYL ALCOHOL. C. S. Marvel and G. Esler Inskeep, University of Illinois.

Direct evidence for a terminal aldehyde group has been found since polyvinyl alcohol gives a 2,4-dinitrophenylhydrazone derivative. The molecular weights of this derivative calculated from its nitrogen content and from viscosity data on solutions are in joint agreement. The absorption spectrum of this derivative in the ultraviolet is similar to those of related monomeric aldehyde derivatives.

THE PHYSICAL STRUCTURE OF PHENOPLASTS. R. A. Barkhuff, Jr., and T. S. Carswell, Monsanto Chemical Co., Plastics Division.

The rate of network formation when cured phenolic films are swollen in acetone, is helpful in investigating phenoplasts in advanced states of cure. This technique has been applied in an investigation of the effect of catalyst concentration, reactant ratios, temperature of initial reaction and temperature of cure on the degree of cure in the final hardened resin. The existing concepts of resin structure are reviewed in the light of this additional experimental evidence. A modified concept of phenoplast structure which more closely conforms with the experimental facts is proposed.

MECHANISM OF BRANCHING IN POLYMERIZATION REACTIONS. G. Goldfinger, Godfrey L. Cabot, Inc.; and W. J. Zybert and H. Mark, Polytechnic Institute of Brooklyn.

Certain molecules such as quinones, have the property of inhibiting polymerization reactions. Past investigators noticed the proportionality of the length of the induction period and the initial concentration of inhibitor and a sharp increase of the molecular weight of the polymer formed in the time interval following the induction period. By a careful investigation of the length of the induction period, the initial rate of polymerization, and the initial change of molecular weight, it was possible to show that inhibition is a complex reaction, involving the formation of at least one intermediate product, which acts as retarder for the polymerization. From the experimental results so far obtained, it was also possible to calculate the A and E constants for the initiation process of the noncatalyzed polymerization of styrene. The respective values are:

$$A = 10^8 \text{ sec.}^{-1}$$
$$E = 27{,}000 \text{ cal. per mole}$$

A mechanism involving one inhibiting and one retarding reaction step in addition to activation, growth and termination is proposed; it is in accord with the experimental results.

(*Please turn to next page*)

Preliminary experimental results are available in which the study of the induction period and the initial number average molecular weight permits direct estimate of chain transfer.

CRYSTALLINITY AND MELTING OF LINEAR POLYMERS. W. O. Baker and C. S. Fuller, Bell Telephone Laboratories.

Further evidence for the independent action of molecular segments in high polymeric compounds is presented as derived from heating and cooling data. Studies carried out on pure linear polyesters and polyamides show that phenomena analogous to those found in low molecular chain compounds occur. A discussion of the results based on the knowledge of the crystalline behavior from x-ray studies is presented.

PREPARATION AND PROPERTIES OF STARCH ACETATE. Lee T. Smith and R. H. Treadway, Eastern Regional Research Laboratory.

Potato starch has been acetylated by 2 methods. By Method I, the starch was esterified in a mixture of acetic acid, acetic anhydride and a suitable catalyst. By Method II, starch was swelled by formic acid and then catalytically esterified with acetic anhydride. Perchloric and sulfuric acids were found to be superior among a number of catalysts evaluated. The acetylation of starch preswelled with formic acid requires approximately 1 hr. at 95° C., in comparison with 9 hr. for unmodified starch.

Starch acetates having a wide range of viscosity and with different solubility characteristics were made by diversified conditions of preparation to obtain products of varying degrees of degradation. Owing to the short reaction time, acetyl starch prepared by Method II is only slightly degraded. As a result, this method gives esters having the higher viscosity solutions. By Method I, air-dry starch gives an acetate of higher viscosity than oven-dried starch of nearly zero moisture content. Oven-dried starch is preferable for Method II. In dilute solutions of organic solvents starch acetates prepared by Method II have viscosities of the same order as high viscosity commercial cellulose acetate.

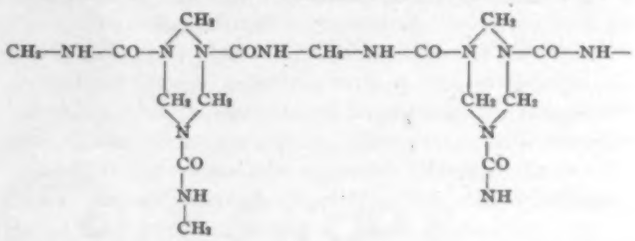
Starch acetates produced by these 2 methods, although they give brittle films in the unsupported state, appear promising applied as lacquers to wood, paper and other fibrous materials and used as water-resistant adhesives, cements and binders.

THERMODYNAMICS OF HIGH POLYMER SOLUTIONS. II. DILUTE SOLUTIONS. Paul J. Flory, Standard Oil Development Co.

The statistical treatment of mixtures of long-chain polymer molecules with monomeric substances recently developed by Huggins and the writer leads to partial molal entropies of dilution which appear to be in good accord with experimental values at high concentrations of polymer, but which can scarcely be reconciled with results at low concentrations. It was assumed that the liquid "lattice" partially filled with polymer molecules can be represented satisfactorily by a random distribution of occupied sites. This assumption breaks down completely in dilute solutions. An analysis of the problem which avoids this assumption gives results in good accord with the best osmotic pressure data on dilute polymer solutions. The effective size of polymer molecules in solution estimated from the osmotic pressure-concentration relationship are in rough agreement with similar estimates based on viscosity measurements.

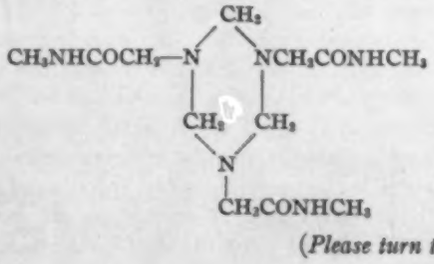
STRUCTURE OF THE POLYMER FROM UREA AND FORMALDEHYDE. C. S. Marvel, University of Illinois; J. R. Elliott, General Electric Co.; and Henry Yuska, Barrett Division, Allied Chemical and Dye Corp.

The reaction between urea and formaldehyde has received considerable study and wide industrial use, but so far, no structure of the polymeric product is consistent with the fact that urea reacts with formaldehyde to give a polymer whereas none of the substituted ureas will do so. It is, of course, known that methylol urea, $NH_2CONHCH_2OH$ and dimethylol urea, $HOCH_2NHCONHCH_2OH$, are the intermediates first formed and that the production of the polymer is accomplished by the loss of water and formaldehyde from these intermediates. It is now suggested that 2 principal reactions are involved in the formation of urea-formaldehyde condensation products. Urea shows many properties of an aminoamide. If one of the $-NH_2$ groups is considered to be a primary amine and the other $-NH_2$ group an amide, their respective reactions with formaldehyde might be predicted as Schiff's base formation and formation of a methylene-bis-amide. Most low molecular weight Schiff's bases trimerize readily. If these reactions occur in the condensation of urea and formaldehyde, the structure of the polymer should be



If the cyclic intermediate forms first, it leaves 3 reactive amido groups to react with formaldehyde and gives the three–two ratio of reacting positions characteristic of the phenol-formaldehyde reaction and the glycerol-phthalic anhydride reaction. Terminal amido-methylol units would interact on further heating to cause the heat-hardening which is characteristic of the product. The known nitrogen content of the polymers agrees with this view of the structure. Indirect evidence of the above structure of the urea-formaldehyde polymer has been obtained by studying polymers from formaldehyde and typical aminoamides. Glycinamide, $NH_2CH_2CONH_2$, and formaldehyde react to give a heat-hardening resin which closely resembles the urea-formaldehyde product in its behavior. The final polymer has a nitrogen, carbon and hydrogen content which indicates it has 1.5 methylene units per glycinamide and this points to a structure analogous to that given above for the urea formaldehyde polymer. Epsilon-aminocaproamide, $NH_2(CH_2)_6CONH_2$, likewise gives a polymer with 1.5 methylene units per aminoamide unit. This product has much greater flexibility than either the urea or glycinamide derivative.

When the N-methylamide of glycine is treated with formaldehyde, no polymer is produced but the expected trimer was isolated. This is consistent with the fact that substituted



(*Please turn to page 148*)

A QUESTIONNAIRE THAT YOU SHOULD USE ON YOUR PLASTICS SUPPLIER

1. Do you do injection molding?
   A. We do.
2. Do you do compression molding?
   A. You bet.
3. Do you do extruding?
   A. Miles of it.
4. Do you do transfer molding?
   A. Yes, sir.
5. Do you do hollow forming?
   A. Ditto.
6. Do you do fabricating?
   A. The answer is yes again.

We also make sheets, rods and tubes.

(signed) Great American Plastics Co.

The fact that we manufacture all plastics by Injection and Compression Molding, Extrusion and Hollow Molding, Transfer Molding and Fabricating makes us the selected source of supply for many branches of the Armed Forces and for many important prime contractors. We meet specifications for all industries—we will be glad to cooperate on your plastics problems—both war and postwar.

THE GREAT AMERICAN PLASTICS CO.

"Plastics Fabricated by Every Method Known to Industry"

INJECTION • EXTRUDING • COMPRESSION • TRANSFER MOLDING • HOLLOW MOLDING & FORMING • SHEETS • ROD-TUBES AND SPECIAL SHAPES

Telephone: Leominster 1650 • LEOMINSTER, MASSACHUSETTS • Teletype Leominster 295

New York City Sales Agency: 27 West 20th Street • Chelsea 3-0267-8

TECHNICAL BRIEFS

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments

Engineering

ACRYLATE AND VINYL CHLORIDE RESIN DISPERSIONS. A. Renfrew and C. F. Flint. Industrial Chemist *19*, 194–8 (1943). Dispersions of plasticized polyvinyl chloride are satisfactory substitutes for rubber latex. Films prepared from dispersions containing 40 percent solids, half polyvinyl chloride and half plasticizer, were weak and fragile when dried at room temperature, but were stronger and resembled natural rubber in softness and flexibility after baking. The materials were improved by thickening the dispersions with sodium alginate. Dibutyl phthalate and tri-*o*-cresyl phosphate are suitable plasticizers. Tensile strengths of 1000 lb./in.^{2} and 200 percent can be obtained from the aqueous dispersions.

PROBLEMS AFFECTING THE USE OF WOOD IN AIRCRAFT. R. W. Hess. Mech. Eng. *65*, 653–6, 660 (Sept. 1943). Continued use of wood in aircraft structures and for some other highly stressed applications, in the face of intense competition from other materials, is dependent in part upon the amount of detailed engineering data that is made available in the near future and upon the extent to which the wood materials and wood products are improved in uniformity and quality. Comparative data on elastic modulus, modulus of rupture, fiber stress in bending, compressive strength, fiber stress in compression and shear strength are given for 35 species of wood. The most promising type of wood construction is lightweight-core plywood.

DERMATITIS DUE TO THE FORMALDEHYDE RESINS. K. E. Markuson, T. F. Mancuso and J. S. Soet. Ind. Med. *12*, 383–6 (June 1943). Resins made with formaldehyde cause dermatitis of workers handling them unless proper engineering and medical controls are used. The dermatitis takes the form of a fine rash and is associated with an itching sensation and a redness of the skin. The following medical preventives are suggested: (1) provide adequate washing facilities; (2) require a regular washing schedule; (3) supply properly designed protective clothing; (4) use protective creams and ointments; (5) hand instruments and machinery should be kept clean; (6) educate workers in proper handling methods; (7) caution workers not to scratch or further irritate the skin. The following engineering control measures are recommended: (1) enclose all mixing operations to prevent contamination of the atmosphere with dust; (2) provide adequate ventilation; (3) segregate operations which produce fumes and ventilate adequately and properly; (4) use mechanical installations wherever possible; (5) clean premises to remove accumulated dust and provide clean dusting cloths at each shift.

Chemistry

SOME REMARKS ON THE KINETICS OF VINYL DERIVATIVE POLYMERIZATION. J. Abere, G. Goldfinger, H. Mark and H. Naidus. J. Chemical Physics *11*, 379–86 (Aug. 1943). The various elementary steps of vinyl polymerization reactions are discussed. Activation is considered to occur by collision of unactivated monomer either with another monomer, a catalyst, a solvent or a polymer molecule. Certain types of active nuclei can be more easily deactivated than others. Two steps of propagation are considered: normal chain growth and chain transfer. Equations are derived and applied to experimental data on the polymerization of styrene at various temperatures, monomer concentrations and catalyst concentrations.

ROLE OF pH IN SYNTHETIC RESIN CONDENSATIONS. M. Déribéré. Chimie & Industrie *47*, 23–30 (1942). The differences in urea and phenolic resins formed by condensation reactions at various pH values, methods of measuring pH and methods of controlling pH are discussed.

Properties

PLASTIC SPECTACLE LENSES. H. H. Emsley. Proc. Physical Society *55*, 314–21 (July 1943). Methyl methacrylate resin possesses all the attributes, except hardness, desirable in a material for spectacle lenses. It is especially resistant to impact and splintering and is light in weight. The manufacture of plastic lenses, in which the lapping operations necessary with glass are replaced by a simple molding operation, is briefly described. Plastic lenses for binoculars, telescopes and photography as well as plastic spectacle lenses, are in production. The light transmissions for methyl methacrylate resin and spectacle crown glass, respectively, are reported as follows: (a) visible, 92 and 91.5 percent; (b) ultraviolet, 2.3 mm. thick specimens, 340 mμ, 82 and 80 percent; 310 mμ, 62 and 25 percent; 290 mμ, 36 and 0 percent; (c) infrared, 5 mm. thick specimens, 1000 mμ, 90 and 90 percent; 1400 mμ, 55 and 90 percent; 2000 mμ, 50 and 90 percent; 2200 mμ, 12 and 87 percent; 2500 mμ, 8 and 85 percent.

THE MECHANICAL PROPERTIES OF TRANSPARENT SYNTHETIC MATERIALS AT 20° C. W. Küch. Luftfahrt-Forsch. *19*, 111–20 (1942). The mechanical and elastic properties of several methacrylic ester resins, of polyvinyl chloride, of cellulose acetate and of polystyrene were investigated at room temperature. Short- and long-time loading, creep and impact tests were made. Most of the methacrylic ester resins and polystyrene were brittle. One methacrylic ester resin, cellulose acetate and polyvinyl chloride were tough. These materials had 54 to 74 percent of their tensile strength in 30-day static load tests. Tempering of the acrylic resins had no effect on the mechanical properties, although hot working had an effect.

BEHAVIOR OF PLASTICIZERS IN VINYL CHLORIDE-ACETATE RESINS. M. C. Reed. Ind. Eng. Chem. *35*, 896–904 (Aug. 1943). Methods for the evaluation of plasticizers for use in vinyl chloride-acetate copolymers are described; 46 different plasticizers are evaluated. Elongations at 1000 lb./in.^{2} at 3 temperatures, volatility, water extraction, oil extraction and flex temperature are tabulated for a series of elastomeric compounds containing 30 to 40 percent of plasticizer, and these data are interpolated to a percentage yielding a standard flexibility. A special oven was built for volatility tests, and the amount of ventilation required was calculated.

Testing

TESTING AND EVALUATION OF UREA RESIN MOLDING POWDERS. W. Esch. Kunststoff-Tech. u. Kunststoff-Anwend. *11*, 317–19 (1941). Pieces of urea-formaldehyde plastic were subjected to a boiling water test and stored at various conditions immediately after removal from the water. The pieces were stored at 20° C. at 35, 65 and 100 percent relative humidity, and in a vacuum desiccator over concentrated sulfuric acid, respectively. The results indicate that material for use in tableware should be stored for 24 hr. at 20° C. and 65 percent relative humidity after removal from the boiling water. Satisfactory materials should show not more than hairline cracks at the conclusion of the test. Materials which pass the immersion in boiling water may not be satisfactory in service or after this storage period.

HEAT GENERATION IN FLEXED RUBBER. S. D. Gehman, P. J. Jones and D. E. Woodford. Ind. Eng. Chem. *35*, 964–71 (Sept. 1943). A flexometer is described which is adapted for the accurate and rapid determination of the temperature rise in a rubber test piece due to flexing in compression. Curves illustrate the effect of amplitude, cure, pigment loading and other factors on the temperature rise for Hevea and GR-S stocks.



FOR *Direct Action* . . . SEE NIXON

Our plant facilities are extensive enough to handle any order . . . large or small. Our sales and service organization is set up to give customers quick action on their telephone, mail or telegram inquiries. If we have the material you want in stock, the chances are we can ship it right away . . . if not, we will tell you when. In short, for direct action . . . See NIXON. Telephone, write or wire direct . . . or contact our nearest representative.

NIXON *Plastics*

MATERIALS: Cellulose Acetate • Cellulose Nitrate • Ethyl Cellulose

AVAILABILITY: Sheets • Rods • Tubes • Extruded Profiles
Cellulose Acetate and Ethyl Cellulose Molding Powder

NIXON NITRATION WORKS INC. NIXON NEW JERSEY

H. J. FAHRINGER	T. C. McKENZIE	A. F. PERRY	W. S. MOWRY	C. B. JUDD
1219 N. Austin Blvd.	618 Fisher Bldg.	Leominster	126 Marsdon St.	401 Loudermann Bldg.
Chicago, Ill.	Detroit, Mich.	Mass.	Springfield, Mass.	St. Louis, Mo.
Esterbrook 4242	Madison 4400	Leominster 1011	Springfield 4-7121	Chestnut 8495

HOBBS GLASS, LTD., *Canadian Distributors* — Quebec • Montreal • Ottawa • Toronto • Hamilton
Brantford • London • Windsor • Winnipeg • Moose Jaw • Saskatoon • Vancouver • Victoria

PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals mentioned directly to publishers

General

PLASTICS IN MEDICINE. Scientific American *169*, 22 (July 1943). Properties such as toleration by human tissues, lightness in weight, transparency to x-rays and toughness adapt the plastics for use in medicine. Over 300 skull operations have been made by one surgeon in which a cranial defect was repaired with a plate of cellulose nitrate. Cups made of methyl methacrylate resin are used for arthritic hip operations. This material is also used for jaw and knuckle joints and in bone grafting and plastic surgery. Nylon filament is used for sutures. Devices used to throw light into recesses are made of methyl methacrylate resin. Instruments and shields are also made of this material. Some of the devices made from plastics are containers for pills, capsules, vaccination shields, nose guards, artificial fingers, splints, catheters, windows for oxygen tents, respirators, therapeutic boots, dentures, transfusion tubes, windows in plaster casts, incubator covers, drainage tubes, retractors, tongue depressors, parts for stethoscopes, cystoscopes, sigmoidoscopes, protoscopes, otoscopes and pharyngoscopes, brain and tonsil probes, and speculums.

THE PRACTICAL USE OF PLASTICS IN BUILDING AND CONSTRUCTIONAL WORK. F. S. Snow, A. Caress and R. J. Schaffer. Chemistry & Industry *62*, 287–90 (July 31, 1943). The problems involved in the utilization of plastics in the building industry are discussed in a general way. Particular emphasis is placed on the high cost of plastics compared to ordinary building materials, to the small production of plastics and to many applications in building in which plastics are not suitable. It is recommended that more development work be done and that service tests be made on the more costly public, monumental and commercial buildings before the materials are used in a large way on housing projects.

Materials

FACTORS AFFECTING THE COLOR AND CLARITY OF CASEIN PLASTICS. H. F. Fick and H. H. Sommer. J. Dairy Science *26*, 591–607 (July 1943). Equipment is described and procedures are given for converting casein into plastic test strips that are suitable for accurate color and clarity measurements. Transparent casein plastics have been prepared with a light transmission 91.7 percent of that of a 2.5 mm. thick piece of photometer cell glass. By extracting a rennet casein of good quality with alcohol or acetone at 140 to 150° F., it is possible to make a plastic from it with very low color and high transparency. Fat contained in the casein is largely responsible for the opacity of the plastic. Other factors involved in control of the color and opacity of casein plastic are discussed.

IMPROVEMENTS IN UREA-FORMALDEHYDE ADHESIVES. S. F. Seperski. Wood Products *48*, 14–15, 57 (April 1943). Urea-formaldehyde resin adhesives meet the requirements for a cold-setting resin glue for wooden aircraft construction. Acid phosphates, such as sodium acid phosphate and acid borates, are replacing hydrochloric acid as the catalyst; these increase the curing time. Melamine may be added to urea-formaldehyde resins to reduce the acidity and to increase the resistance to water. Urea-formaldehyde resins can withstand immersion in water at 140 to 150° F.; some melamine modified urea-formaldehyde resins can withstand boiling water to some extent. Resorcinol is also used in the synthesis of cold-setting urea-formaldehyde resin to increase resistance to water. Walnut shell flour is generally used as a filler in urea-formaldehyde resin glues. Liquid urea-formaldehyde resins when stored at 50° F. may be kept fluid and usable as long as a year.

PROPERTIES AND CHARACTERISTICS OF ETHYL CELLULOSE. Wm. Koch. Product Eng. *14*, 506–9 (Aug. 1943). The properties of 5 types of ethyl cellulose, ranging in ethoxyl content from 43.5 to 50.0 percent, are described. The properties discussed include solubility, compatibility with various materials, electrical properties, flammability, heat stability, water absorption and mechanical properties. Typical applications are described.

DERIVATION OF PRINCIPAL SYNTHETIC RESINS. R. J. Moore. Chemical Industries *53*, 56–7 (July 1943). A chart is presented showing the production of many commercial organic plastics from natural gas, petroleum, coal, air and water. Intermediates are shown.

Applications

PLASTIC BATTERY RETAINER. Iron Age *152*, 67 (July 22, 1943). A plastic storage battery retainer plate made of polystyrene is described. The plates act as holders for the active material in the positive plates and as insulators between the positive and negative plates.

SPOTLIGHT ON PLASTICS FOR PLUMBING AND HEATING. J. C. Louer. Domestic Eng. *161*, 44–6, 108 (April 1943). A general discussion of plastics with particular emphasis on those properties which are of interest in plumbing and heating installations.

POLYVINYL ALCOHOL: A MEDIUM FOR MOUNTING AND CLEARING BIOLOGICAL SPECIMENS. W. G. Downs. Science *97*, 539–40 (June 11, 1943). Directions are given for mounting biological specimens in polyvinyl alcohol. Stained blood films have been preserved in this medium for 2 years without distortion. Mosquito larvae, many small organisms, and motile microorganisms may also be mounted successfully with polyvinyl alcohol.

APPLICATION OF "HOT" LACQUERS AND DOPES. R. L. Ericsson. Am. Paint J. *27*, 40–52 (May 10, 1943). The application of lacquers and dopes at elevated temperatures has the following advantages: (1) The number of manhours required for a given finishing operation is reduced. (2) Fewer coats of coating material are required because the individual coats are thicker. (3) Higher solids content is used which reduces cost because less solvent is required. (4) Less sagging develops on coating vertical surfaces. The increase in temperature reduces the viscosity materially; a rise in temperature from 80° F. to 150° F. reduces the viscosity of a typical lacquer about 75 percent. The solvent mixtures used in hot applications have slower evaporation rates than those ordinarily used. Recommendations regarding substitutions are (1) butyl acetate and butyl alcohol for ethyl acetate, methyl ethyl ketone and ethyl alcohol, and (2) xylene and higher boiling naphthas for toluene and low boiling naphthas. The use of larger amounts of diacetone alcohol and butyl lactate is also recommended. The solvent formulation for hot application should contain a lower percentage of diluents than ordinary lacquers do. Drying time is about the same as for ordinary lacquers. Data are presented in tabular and graphic form.

Coatings

VISCOSITY OF SOLUTIONS IN BRANCHED-CHAIN PARAFFINS. E. H. McArdle and A. E. Robertson. Ind. Eng. Chem. Anal. Ed. *15*, 484–7 (Aug. 15, 1943). Solutions of an alkyd-type resin, natural rubber, Butyl rubber and Buna S, at high concentrations in 2 pentanes, 4 hexanes, 5 heptanes and 2 octanes show much higher absolute and relative viscosities in the branched paraffins than in the corresponding normal paraffins. An arbitrary method of predicting the viscosity of the resin solutions in branched paraffins has been devised. Large differences between solution viscosities suggest a rough method of hydrocarbon analysis.

12oz. H·P·M

LARGEST MACHINE EVER CONVERTED TO JET MOLDING



These four plugs represent the largest "shot" ever produced by Jet Molding. Total wt.-11 ounces.

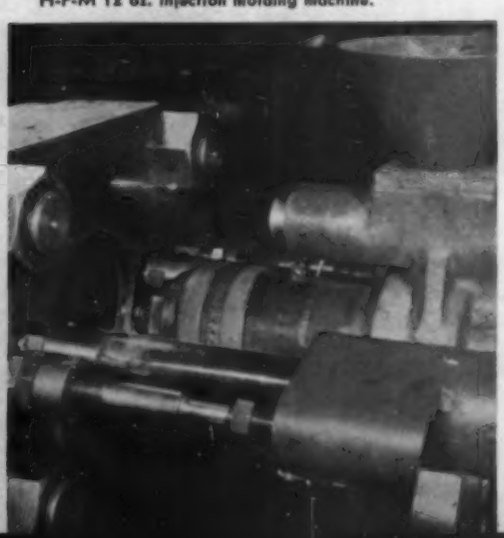


H-P-M injection molding machine installed in the plant of Evans-Winter-Hebb, Detroit, Michigan.

four cavity mold (for Jet Molding) installed in the H-P-M 12 oz. injection molding machine.



Injection chamber (for Jet Molding) installed on the H-P-M 12 oz. injection molding machine.



The machine illustrated is a 12 oz. H-P-M injection molding machine, equipped with Jet Molding conversion unit.

For molding either thermoplastic or thermosetting resins . . . choose H-P-M injection molding machines. The H-P-M "All Hydraulic" mold clamp and injection units provide accurate and flexible control of the entire molding cycle. H-P-M HYDRO-POWER hydraulic pumps and valves guarantee minimum operating costs. Write today, stating your particular molding requirements.

HPM

Plastics Division

THE HYDRAULIC PRESS MFG. COMPANY

Mount Gilead, Ohio, U.S.A.

District Sales Offices: New York, Syracuse, Detroit and Chicago. Representatives in Principal Cities.



U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each

GLASSINE PAPER. T. A. Kauppi and R. W. Kolderman (Dow Chemical Co.). U. S. 2,325,408, July 27. Paper is precoated with an aqueous emulsion of ethyl cellulose lacquer, dried and coated with a low viscosity ethyl cellulose melt.

POLYVINYL HALIDES. W. O. Herrmann and W. Haehnel (to Alien Property Custodian). U. S. 2,325,513, July 27. Halogenated polymeric vinyl compounds are prepared by halogenation in anhydrous acetic acid solution of polyvinyl alcohol, its esters and acetals.

COATINGS. W. Mertens (to Alien Property Custodian). U. S. 2,325,531, July 27. Coating, comprised of polyisobutylene interpolymerized with a mixture of styrene and divinyl benzol, dissolved in a solvent having an aliphatic and an aromatic component.

LIGNOCELLULOSE RESINS. R. Katzen, R. H. Plow and E. T. Olson (to Northwood Chemical Co.). U. S. 2,325,570, July 27. Molding compound comprising phenol-formaldehyde resin and hydrolyzed lignocellulose and having a pH of 3 to 6.

LAMINATES. C. Dreyfus. U. S. 2,325,688–9, August 3. Composites comprising metal laminated with plastic, and wood laminated with plastic.

WOOD LAMINATE. W. H. Moss (to Celanese Corp. of America). U. S. 2,325,700, August 3. Cellulose acetate sheet and wood veneers, of lesser thickness than the plastic, are bonded with heat and pressure.

CALKING COMPOUND. H. L. Acker (to W. P. Fuller and Co.). U. S. 2,325,726, August 3. A calking compound consisting of unmodified alkyd resin, derived from a polyhydric alcohol and an aliphatic di-carboxylic acid, an inert filler such as ground mica or asbestos fiber, and zinc chromate.

POLYVINYL HALIDE. T. L. Gresham (to B. F. Goodrich Co.). U. S. 2,325,951, August 3. A vinyl chloride polymer is plasticized with a phthalic acid ester of alcohols having at least 6 carbon atoms.

ADHESIVE. de F. Lott, H. Grinsfelder and E. G. Hamway (to Textileather Corp.). U. S. 2,325,963, August 3. A fibrous base is coated with a film of thermo-fusible material, composed of a copolymer of vinyl chloride and vinyl acetate, a stabilizer of calcium stearate and a plasticizing mixture of dibutoxyethyl phthalate and butoxy ethyl stearate, and united with textiles.

COATING COMPOSITION. R. C. Swain and P. Adams (to American Cyanamid Co.). U. S. 2,325,986, August 3. A coating containing cyclicized rubber, obtained by reacting rubber with amphoteric metal halides and a melamine-formaldehyde resin alkylated with an acyclic alcohol containing 3 to 8 carbon atoms.

POLYSTYRENE COATING. R. C. Swain and P. Adams (to American Cyanamid Co.). U. S. 2,325,987, August 3. A coating containing polystyrene and a melamine-formaldehyde resin reacted with a monohydric alcohol containing 6 to 8 carbon atoms.

SYNTHETIC RESIN. H. A. Bruson (to Resinous Products and Chemical Co.). U. S. 2,326,006, August 3. A condensation product of formaldehyde and an ester of a polyhydric alcohol and acetoacetic acid.

PLASTIC MOLDING. L. J. A. Lavallee. U. S. 2,326,041, August 3. Receptacle-like objects are molded from plastic material by placing a pre-form in a mold cavity and heating.

POLYVINYL ACETAL RESIN. J. G. McNally, C. R. Fordyce and R. H. Talbot (to Eastman Kodak Co.). U. S. 2,326,048, August 3. A polyvinyl acetal resin is prepared by polymerizing vinyl acetate in a solvent and incorporating a deesterification catalyst, an aldehyde and a monohydric alcohol or water.

METHACRYLIC ACID POLYMER. E. Trommsdorff and B. Abel (to Rohm and Haas Co.). U. S. 2,326,078, August 3. Alkali soluble polymer is formed by suspending methacrylic acid in an aqueous solution of a neutral salt of a mineral acid, the cation of which is capable of forming water soluble methacrylate salts, and subjecting to polymerizing conditions.

LAMINATING FABRIC. W. W. Rye (to Celanese Corp. of America). U. S. 2,326,190, August 10. Fabrics composed of yarns of cellulose carboxylic acid esters, cellulose ethers, mixed carboxylic acid esters of cellulose, synthetic linear polyamide condensates and non-thermoplastic fibers, are treated with an aqueous dispersion of a plasticizer which dispersion contains an organic derivative of cellulose as the dispersing agent.

LAMINATED GLASS. B. J. Dennison (to Pittsburgh Plate Glass Co.). U. S. 2,326,203, August 10. Glass plates are united by a plastic reinforcing material, a border of the plastic projecting beyond the edges of the glass, and layers of flexible metal foil are adhered to the plastic border and edges of the glass plates.

UREA FORMALDEHYDE RESIN. P. O. Towney (to Sherwin-Williams Co.). U. S. 2,326,265, August 10. Two moles of formaldehyde and one mole of urea are condensed in the presence of alkali in a water solution of a volatile organic solvent at 57–80° C. for 2–6 hr., the water is then reduced to 20 percent by adding a weak acid catalyst and a solvent boiling over 100° C., the water is distilled off until a syrup is formed at which point a strong acid is added, and the distillation is continued until a water-free syrup is obtained which is diluted with a solvent to form a resin solution when cold.

UNSATURATED ISOCYANATE COPOLYMER. D. D. Coffman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,326,287, August 10. An organic isocyanate, in which the isocyanate group is attached to a carbon atom attached by a double bond to another carbon atom and which carbon atoms are attached to monovalent organic radicals and not hydrogen, is copolymerized with vinyl or vinylidene compounds.

POLYMERIZATION METHOD. J. Breedis (to Rohm and Haas Co.). U. S. 2,326,326, August 10. A methacrylic resin is prepared by injecting into water at 90–125° C., water insoluble, polymerizable liquid methyl methacrylate, ethyl methacrylate or mixtures thereof, and at least one of the group consisting of acrylic esters, nitriles, vinyl acetate and styrene, through an orifice so as to form such small particles that they are polymerized in a few seconds, followed by removal and drying of polymerized material.

(Please turn to next page)

WHAT GOOD ARE A THOUSAND NEARLY RIGHT ANSWERS?



Among the many new plastic materials coming to the fore and new manufacturing processes being developed, there could very well be a thousand answers to your plastics problem—whether it is a complete product or a vital precision made component part. But, you'd rather have just one right answer, wouldn't you?

We, here at Tech-Art, have won an enviable reputation for producing right answers. And, no wonder! We know plastic materials inside out. In our compression room alone, we have over 100 presses of varying sizes—fully automatic, semi-automatic and hand molding presses—doing all kinds of jobs. On injection molding, we have scored a number of "firsts". Now we're several steps ahead of the field in new low pressure molding techniques. Add to this the fact that we make our own dies in one of the finest tool shops you ever saw and that our designers have a flare for turning the seemingly impossible into actual reality and you've got a number of excellent reasons why you too* should "take it to Tech-Art".

Back of such tangible resources and facilities you'll find one of our most worthwhile assets, namely, a spirit of cooperation that you will enjoy working with. Even if you don't have a plastics problem right now, you will have. The right answer to it will save many headaches and many dollars And that's where we come in.

* Experienced Purchasers of Precision Plastic Parts

"Turn to Tech-Art"

TECH-ART PLASTICS COMPANY

(Pioneer Molders — Established 1891)

Subsidiary to Boonton Rubber Mfg. Co.

36th Avenue and 41st Street · Long Island City, New York

AStoria 8-6050-1

BOBBIN HEAD. M. C. Dodge (to Columbian Rope Co.). U. S. 2,326,526, August 10. A bobbin head formed by molding a mass of fibers and a thermosetting binder.

COLORING. W. E. F. Gates (to Imperial Chemical Industries Ltd.). U. S. 2,326,531, August 10. Artificial teeth having color gradation prepared by mixing methyl methacrylate with polymethyl methacrylate into a dough, rolling the dough into a sheet, coating the sheet with a dyestuff solution, and molding teeth in preforms at a high temperature.

POWDERED RESIN. E. P. Isany (to Shawinigan Chemicals Ltd.). U. S. 2,326,539, August 10. Boric acid is mixed with a thermoplastic resin containing several aliphatic hydroxyl groups per molecule, reacting the acid with the material to give a brittle reaction production which may be ground to a powder after which the boric acid is driven off leaving the resin powder.

MOLDING COMPOSITION. M. L. Macht (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,326,543, August 10. A molding composition comprising a mixture of methyl methacrylate copolymerized with styrene or vinyl acetate, and a polyvinyl resin.

MOLDING COMPOSITION. F. Rosenthal (to University of Tennessee Research Corp.). U. S. 2,326,569, August 10. A molding composition comprising a phenol-formaldehyde resin, a filler of comminuted cottonseed hull bran and fiber.

COATING COMPOSITION. E. W. Crosby (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,326,623, August 10. A spray coating composed of ultramarine blue pigment, lithol red pigment, bone black, aluminum pigment, 2 alkyd resins, urea-formaldehyde-monohydric alcohol resin, driers, hydrocarbon solvents and raw rubber.

COATING COMPOSITIONS. R. C. Swain and P. Adams (to American Cyanamid Co.). U. S. 2,326,698-9, August 10. Coatings composed of polyvinyl acetate methylal or polyisobutylene and a melamine-formaldehyde resin which has been reacted with butyl or benzyl alcohol.

BOTTLE SEALING. A. Burkardt (to Pneumatic Cap and Seal Corp.). U. S. 2,326,722, August 10. A hood seal for bottles comprising a cup-shaped fibrous core having a coating of thermoplastic material on outer and inner faces capable of being rendered tacky at 350 and 135° F., respectively.

CURING CATALYST. D. W. Jayne, Jr., and P. C. Schroy (to American Cyanamid Co.). U. S. 2,326,725, August 10. An acid curing thermosetting resin contains a latent curing catalyst selected from the group consisting of *n*-acyl imides and *n*-acyl sulfonamides.

CURING CATALYST. P. C. Schroy (to American Cyanamid Co.). U. S. 2,326,727, August 10. An acid curing thermosetting resin containing a small amount of a compound similar to that obtained by reacting a tertiary monoamine with an acid.

PLASTICIZER FOR THERMOSETTING RESINS. P. C. Schroy (to American Cyanamid Co.). U. S. 2,326,728, August 10. A urea-formaldehyde molding composition is plasticized with N-*p*-toluene-sulfonyl ethanolamine.

POLYMERIZATION PROCESS. D. E. Adelson and H. Dannenberg (to Shell Development Co.). U. S. 2,326,736, August 17. Resinophoric compounds such as vinyl ketones, acroleins, acrylate esters, acrylic acids, acrylonitriles and styrenes mixed with a substituted naphthalene are polymerized by exposure to ultraviolet radiation, the substituted naphthalene behaving as a catalyst.

MOLDING COMPOSITION. D. R. Wiggam (to Hercules Powder Co.). U. S. 2,326,810, August 17. A molding powder comprising ethyl cellulose and hydrogenated resin.

TOOTHBRUSH. D. R. Wiggam and W. Koch (to Hercules Powder Co.). U. S. 2,326,811, August 17. A toothbrush consisting of bristles mounted in a handle molded from ethyl cellulose, a glycerol ester of hydrogenated rosin, refined mineral oil and a water resistant softening modifier.

MOLDING COMPOSITION. D. R. Wiggam and W. Koch (to Hercules Powder Co.). U. S. 2,326,812, August 17. An injection molding powder consisting of ethyl cellulose granules, a resin possessing solvent action on the ethyl cellulose at 350–400° F. but not at 100° C., and a solvent plasticizer.

PLASTIC TRAVELER. W. M. Camp (to Clark Thread Co.). U. S. 2,326,828-9-30-1-2-3-4, August 17. A traveler for ring spinning and twisting, the surface of which comprises a synthetic linear super polymer, a vinylidene chloride polymer, polystyrene, a water insoluble cellulose ether, a plasticized cellulose ester, a vinyl ester polymer or an acrylic polymer.

TUBES AND FOILS. K. Thinius (to Alien Property Custodian). U. S. 2,326,899, August 17. Foils and tubes are formed by preparing a film of a 6-N mineral acid solution of a polyamide, adding thereto a coating of an alkaline solution of cellulose and passing these as a unit through an acid precipitating bath.

MILL. V. Conrad (to Alien Property Custodian). U. S. 2,326,927, August 17. The grinding, mixing and refining of plastics are effected by working on mills.

PLASTICIZED RESINS. F. A. Bent and F. G. Byrne (to Shell Development Co.). U. S. 2,327,007, August 17. A ketone soluble synthetic resin plasticized with a branched chain saturated ketone containing 18 to 24 carbon atoms.

POLYSTYRENE. J. F. Walker (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,327,082, August 17. Styrene is polymerized by the action of an alkali metal in an ether.

POLYAMIDES. D. J. Loder (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,327,116, August 17. Bifunctional material containing 2 amide-forming groups each complementary to an amide-forming group in an ester or a hydrogen-bearing amino group, at least one reactant containing an acetal group, are reacted to form linear polymeric fibers.

POLYVINYL CHLORIDE PASTE. A. Renfrew and J. W. Davison (to Imperial Chemical Industries Ltd.). U. S. 2,327,128, August 17. Pastes are made by plasticizing polyvinyl chloride with tricresyl phosphate, dibutyl phthalate, diamyl phthalate, triethyl citrate, glyceryl tributyrate and ethyl cinnamate.

POLYAMIDE. P. L. Salzberg (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,327,131, August 17. A polyamide is formed by reacting a diamine with dicarboxylic acids containing a lateral acetal group bridging 2 contiguous carbon atoms, and with amide forming derivatives of such acids.

INSULATOR. W. I. Patnode (to General Electric Co.). U. S. 2,327,212, August 17. An elastic tape, capable of being heat treated to a hard state, is prepared by plasticizing vinyl acetal polymer with monomeric methyl methacrylate.

ABRASIVE. N. P. Robie (to Carborundum Co.). U. S. 2,327,218, August 17. An abrasive article comprising abrasive grains and a binder of a polymer mixture including an ester of an acrylic acid.

CELLULOSE ESTERS. A. E. Broderick (to Carbide and Carbon Chemicals Corp.). U. S. 2,327,397, August 24. An aliphatic monocarboxylic acid ester of an hydroxyalkyl cellulose is produced by fibrous esterification with an aliphatic monocarboxylic acid anhydride of an hydroxy alkyl cellulose derived from an unmercerized cellulose in the presence of a catalyst.

RESIN COMPOSITION. M. T. Harvey (to Harvel Research Corp.). U. S. 2,327,422, August 24. A gel of polymerized vinyl chloride, vinyl acetate and copolymers thereof, in a reaction product of formaldehyde with turpentine, pinene, terpineol or pine oil.



ON THE FACE of it, it might appear that recent strict war measures would act as a complete throttle on the progress of postwar plastic product development for the duration. In actual point of fact, current research and the development of postwar plastic products is being spurred more rapidly than ever before.

While it's true that because of stringent regulation of all materials by priority, many product development projects are being perforce outlined only on paper, the driving spirit which has motivated the plastic industry from its very beginning is ever flourishing.

There is no priority on foresight. And because this is America where a man can work and dream of a better future even in the midst of war you'll find blueprints for sales already being drafted in the minds of men who are determined that we shall not only win the war but win the peace as well. Among these men are many who are already planning how they can use plastics for all sorts of postwar jobs. Others are letting their imaginations dwell on new uses of plastic in combination with metals and then engineering them into practical form. These are the forward thinking men at whose disposal we wish to place the broad practical finishing knowledge and research facilities of McAleer, developing finishes which will greatly enhance the practical and appearance value of their postwar plastic products.

Plastic finishing requirements usually present McAleer with a development problem . . . for few finishing needs can be met with standardized "off-the-shelf" buffing and polishing compositions. The accelerated uses of Plastics tomorrow will demand that you have a source of technical finishing information on which you can depend —a source which can provide finishing materials which meet the specific finishing requirements of a wide range of plastic formulae. McAleer in its Plastic Finishing Division stands ready to answer these needs—stands ready to help you draft your Blueprints for Sales today, for tomorrow.

If your war or postwar products have base material listed below, let McAleer Men, Methods and Material help you finish the job.

PHENOL-FORMALDEHYDES • UREA-FORMALDEHYDES • ACRYLATES and METHACRYLATES • STYRENES • HARD RUBBERS
CASEINS • ETHYL-CELLULOSES • CELLULOSE ACETATES • CELLULOSE ACETATE BUTYRATES • CELLULOSE NITRATES

McAleer MANUFACTURING CO.



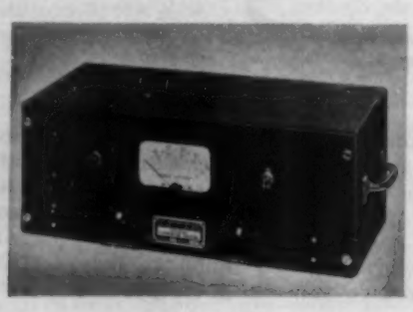
Manufacturers of Quality Controlled Finishing Materials

ROCHESTER, MICHIGAN

MACHINERY *and* EQUIPMENT

★ A PHOTOELECTRIC SYSTEM FOR MEASUREMENT and control of the density of transparent films, filters, plastics, gases and liquids, has been introduced by Photoswitch Inc., Cambridge, Mass. Designed for extreme accuracy, Densitometer Series D90 projects 2 beams of light from a single source. One beam passes through any standard filter; the other beam passes through the filter or liquid the transparency of which is to be measured. The 2 light beams then are projected by an optical system to a single phototube. By means of an electronic and mechanical timing system, the instrument constantly measures the ratio of transparency of the sample as compared with the standard filter.

★ RECENT IMPROVEMENTS IN THE LINE OF ABRASIVE belt grinders of Hammond Machinery Builders, Inc., Kalamazoo, Mich., include a larger and heavier cast base, a larger sludge pan and new pulley-motor mountings easily adjusted from outside the base. While running, not only can the machines be adjusted from vertical to horizontal position but the belt tension and tracking device can be altered. In the "Wet-n-Dri" machines, to change from wet to dry operation it is necessary merely to turn off the water, remove drain connection and attach air exhaust system.



★ NORTH AMERICAN PHILIPS CO., INC., THROUGH its Industrial Electronics Div., New York, N. Y., has announced a new electronic temperature indicator (shown above) which is said to offer many advantages to industries not in need of expensive recording pyrometers. A switch on the front panel of this unit allows selection of 3 temperature "spread ranges." The standard limits are understood to be from −212° F. to 1832° F. with a normal accuracy of about ±2 percent. Five pairs of terminals for 5 thermocouples are provided, any one of which can be switched into the circuit so that the temperature at 5 different points can be read. The instruments can be operated with as much as 100 ft. of connecting wire between thermocouple and indicator, and no technical knowledge is said to be required to operate the unit which weighs 24 pounds.

★ AS THE RESULT OF AN EXPERIMENT DESIGNED to determine the practicability of threading and cutting off plastic pipe, Oster Manufacturing Co., Cleveland, Ohio, has decided that "this pipe can be commercially threaded and cut off in a power machine provided the proper procedure is followed." From information derived from these tests on 2-in. pipe, the company recommends carbon steel dies—one set for each diameter of pipe. It was discovered that the dies must be made with exceptionally full clearance or they will squeeze the thread. Other data obtained from the experiment are that dies used for threading steel pipe will not successfully thread plastic; plastic pipe must be cut dry without use of lubricant; end pipe should be cut off square and left in that condition to thread; the end pipe should not project more than 6 in. from the front chuck; and the pipe should be gripped firmly in the chuck to prevent slipping but not too tightly as to break the pipe. An Oster No. 562-8 "Tom Thumb" portable pipe machine was used in the experiment. This machine, with a capacity ranging from 1/4 to 2 in. in diameter, is furnished with quick opening, fixed die-head or with quick-opening, individual, quick change die-heads and dies.



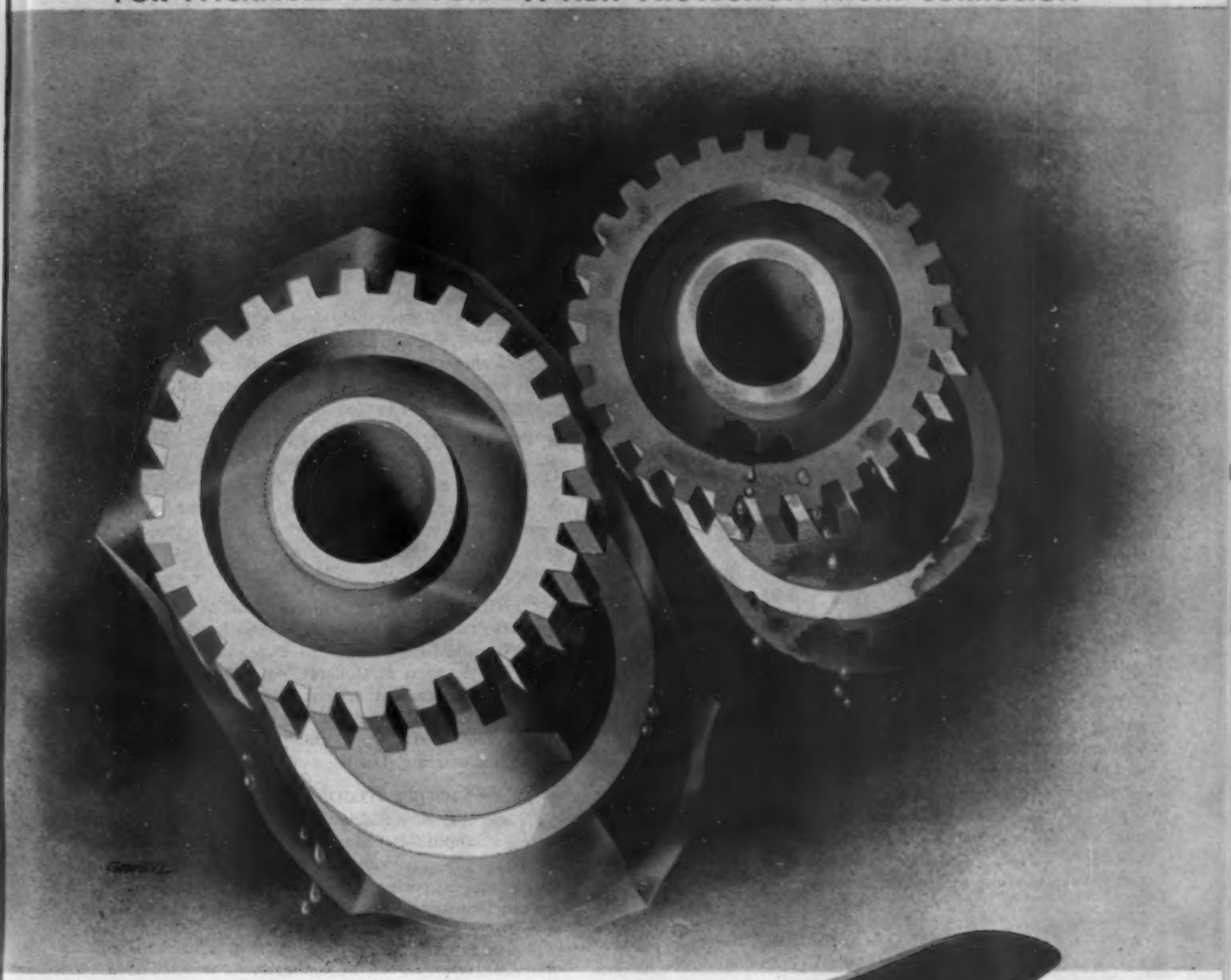
★ BALDWIN-SOUTHWARK DIVISION OF BALDWIN Locomotive Works, Philadelphia, Pa., are manufacturing a new machine for testing the toughness of wood. Developed by the U. S. Forest Products Laboratory, the machine (above) has been tried out successfully in the wooden airplane industry. Disclosing possible physical weakness in wood such as compression defects resulting from proud wood and decay, the testing machine operates by a falling pendulum which breaks a wood specimen supported as a simple beam loaded in the middle. The unit has 15 different loading capacities and 3 speeds to rupture the specimen. Indications of the machine are converted into the number of in.-lb. of energy absorbed in the breaking.

★ DESIGNED TO SAND ANY DEGREE OF BEVEL UP TO 6 in. in height, a new, rapid-production oscillating spindle sander has been introduced by Boice-Crane Co., Toledo, Ohio. Offered in sizes of 3/4 in., 1 1/2, 2 and 3 in., the sander can be used for grinding aluminum, masonite, brass, die castings and sheet iron for templates. An extra large table, 20 by 20 in., tilts both ways 45 degrees, and 2 scribed index lines show exact positions for beveling, drafting patterns and for core-box work.

★ SELENIUM RECTIFIER DIV., FEDERAL TELEphone and Radio Corp., East Newark, N. J., manufacturing associate of International Telephone and Telegraph Corp., now offer battery chargers in a complete line of wide voltage and almost unlimited current range. This line, powered by I. T. & T. selenium rectifiers, is divided into 3 general classes: low voltage type for automotive, aircraft, radio, etc., use; communications type for telegraph, signaling and alarm systems ranging from 24 to 48 volts; and the general utility types for central power stations, machine tools and other general requirements for 110 volts and up. The selenium rectifier, forming the heart of the equipment, is said to be particularly adapted to charging batteries at either high or low rate. Its long life, high power factor and rugged construction are designed to assure satisfactory and economical results from the battery chargers.

★ TO MEET THE DEMANDS OF AIRCRAFT AND marine workers for a bender capable of forming greater diameters than those possible on the company's smaller model, O'Neil-Irwin Manufacturing Co., Minneapolis, Minn., has placed a new unit on the market, the Di-Acro Bender No. 3. With a net weight of 215 lb., the unit is designed to quickly and economically form or duplicate all types of tubing, channel, angle, I-shaped sections and round, square, flat or odd shaped solid or open cross-section materials. With a guaranteed accuracy to tolerance of .001 in. in all duplicated work, the machine has 12 right or left hand operating positions for either bench or pedestal mounting.

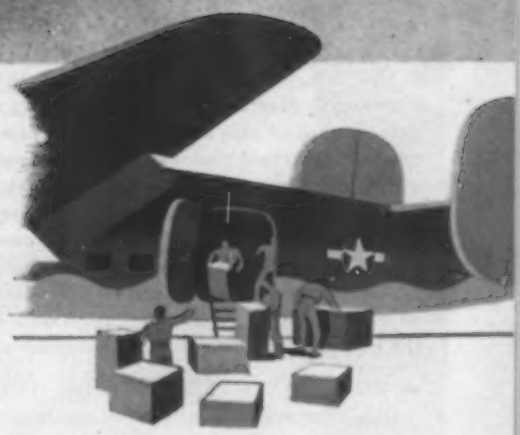
FOR PACKAGED PRODUCTS—A NEW PROTECTION FROM CORROSION



moisture meets its master

In *Saran Film*, a new packaging material developed by Dow, moisture meets its master. It keeps this common cause of rust and corrosion in its place to a greater degree than any other comparable product.

Packaging engineers, developers of the new science of packaging goods for shipment abroad, now insert machine guns and metal parts in flexible envelopes of *Saran Film*. These are the inner membranes of sturdy packages, built up of various other materials. In this instance, the main function of *Saran Film* is to exclude moisture; the outer package provides the strength. Packaging engineers are finding this new material so valuable that it is being acclaimed the packaging development of the year.



THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Cleveland • Chicago • St. Louis • Houston
San Francisco • Los Angeles • Seattle

Saran Film

KEEPS MOISTURE IN ITS PLACE

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

PUBLICATIONS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent postpaid at the publishers' advertised prices

Company Museums

by Laurence Vail Coleman
The American Association of Museums, Smithsonian Institution, Washington, D. C.
Price $2.50 **273 pages**

This book will prove an invaluable guide to the company planning the installation of a museum. Citing companies already in possession of such collections and explaining their usefulness, the book presents the procedure to be followed in setting up such museums. Chapters are devoted to management, quarters, collecting, exhibition and interpretation. L.E.M.

Slide Rule Simplified

by C. O. Harris

American Technical Society, Drexel Ave. at 58th St., Chicago, Ill.

Price $3.50 with rule, $2.50 alone **250 pages**

This is essentially a "how to do it" book. The intention of the author was to make the material understandable to the reader who studies alone. Complete instructions are given on accurate and precise reading of the scales of the slide rule. Each type of calculation—multiplication, division, combinations of multiplication and division, the square and square root, the cube and cube root—all are discussed. The final chapters are intended for more advanced students. The material on these pages deal with sines and cosines, the tangent of an angle and logs and antilogs.

L.E.M.

★ FOR THE BENEFIT OF MANUFACTURERS WHO even now are projecting post-war plans, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., has issued a new handbook on Plastacele. Starting with a one-page pictorial description of the manufacture of this cellulose acetate plastic, the pamphlet devotes space to such topics as: care and handling, general fabricating information, sawing, shearing, blanking and punching, tapping and threading, routing and shaping, finishing, forming, mounting and installation. A table summarizing the physical properties of Plastacele is faced by a page devoted to factors modifying these physical properties. A copy of the booklet will be made available upon application on a business letterhead to the Plastics Department of the company at Arlington, N. J.

★ FULL INSTRUCTIONS FOR THE USE OF DUREZ casting resin supplement a technical discussion of the material in a compact pamphlet just published by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y. The material is divided into 10 sections dealing with patterns, mold making, mixing resin with catalyst and fillers, curing and baking, fillers, wooden cores, inserts, finishing and mounting, and colored cast resins.

★ INFORMATION ON CORRUGATED BOXES HAS BEEN put at the users' fingertips through a series of pocket-size pamphlets issued by Hinde & Dauch Paper Co., Sandusky, Ohio. The 6 little books so far published cover methods of sealing, selling, shipping economically, packing war materials, stacking and loading, merchandising and shipping by air express through use of corrugated boxes. The last booklet covers in question and answer style all the more important phases of shipping by air.

★ CARBIDE AND CARBON CHEMICALS CORP., NEW York, N. Y., has issued a booklet designed to provide complete data on methods for the extrusion of Vinylite resin plastics of the semi-rigid and flexible types using screw type extruders. In addition to discussing machines and nomenclature, the booklet covers temperature control, operating temperatures, and die design and construction. Another publication just issued, the first of a series of 6, presents in digest form information on the mechanical strength factors of Bakelite and Vinylite plastics. Succeeding booklets will discuss other physical properties of these plastics.

★ INVASION BARGES AND POWER PLANTS, TANK factories and paper mills, battle ships and oil refineries—they all require fabricated piping. This fact is clearly brought out in a well-illustrated booklet published by Flori Pipe Co., St. Louis, Mo. In addition to listing sizes and kinds of fabricated piping, the book shows how the various shapes are produced and gives a list of present market prices. The booklet may be obtained by writing to Dept. C-2 in care of the company.

★ TO PROVIDE INFORMATION ON ITS CUSTOM molding facilities and service, Imperial Molded Products Corp., Chicago, Ill., has issued bulletin No. K-200 describing work of the engineering, mold-making, production and finishing departments, and showing typical molded parts produced. A table is included giving characteristics of various types of compression molded plastics.

★ "THE PROCESSING OF ARALAC AND OTHER PROtein Base Fibers" by Henry E. Millson has just been issued by Calco Chemical Div., American Cyanamid Co., Bound Brook, N. J. Designated as Bulletin No. 667, the book covers the manufacture, physical and chemical properties, and uses of Aralac. In addition to discussing in detail the dyeing of Aralac and Aralac unions, dry cleaning problems are treated as are methods of scouring, desizing, boiling and bleaching.

★ IN AN EFFORT TO CONSERVE CUTTING TOOLS THE WPB and War Advertising Council have issued a pamphlet presenting the need for such conservation and suggesting reduction in wastage through education of plant workers and management, by focusing attention on the problem throughout the metal working industry and by encouraging more widespread adoption of tool salvage practices.

★ SO THAT MANUFACTURERS, ENGINEERS AND DEsigners may keep in touch with the latest developments in the plastics field, Plaskon Div., Libby-Owens Glass Co., Inc., Toledo, Ohio, has prepared a book on properties and characteristics of Plaskon in molded form, and discussing in detail the proper methods of fabrication. Full-page color cuts present representative examples of articles molded from this plastic. The appendix to this book contains reports on numerous tests, definitions of physical and electrical terms, weight and measurement tables in addition to other pertinent data.

★ "VELON, THE MIRACLE MATERIAL FOR THE world of tomorrow." In keeping with its title the booklet, just published by Firestone Industrial Products Co., Akron, Ohio, emphasizes the application of Velon to peacetime products. Colored photographs highlight the use of this material for seat covers, interior drapes and furnishings, women's handbags, accessories and radio cabinets. Only one photograph serves to remind the reader to what grim use plastics now are being put in a variety of military equipment.

★ TO ACQUAINT INDUSTRY WITH THE FACTS ABOUT its facilities for manufacturing thermoplastic parts and products, Amos Molded Plastics, Edinburgh, Ind., has issued an elaborate portfolio. Designed so that the heavy covers will hold it in reading position on a desk, this booklet is replete with pictures and statistical information on plastics. Photographs and text combine to inform the reader of the many ways in which the company is prepared to serve its customers.

SYNFLEX

RIGID to FLEXIBLE · RODS · TUBES · SHAPES

COMPOUNDERS AND EXTRUDERS OF SPECIFIC MATERIALS FOR SPECIFIC USES

FLEXIBLE RUBBERLIKE TUBING

TEST DATA	FT-10 Sub-Zero	FT-11 Transparent	FT-22 Versatile	FT-33 Heat
Dielectric Strength Dry VPM	280	1000	1200	900
Wet VPM	450	910	900	800
Low Temperature Flexibility °F. (°C.)	−85 (−65)	−63.4 (−53)	−59.8 (−51)	−22 (−30)
Impact °F. (°C.)	−70.6 (−51)	−54.4 (−48)	−41 (−40.56)	−5.8 (−21)
Elevated Temperature Continuous °F. (°C.)	150 (65.56)	188.6 (87)	194 (90)	190 (87.78)
*Soldering	Flows	Flows	Flows	Good
**Aging (Baking) at 100°C. (212°F.) good after	100 days	100 days	130 days	50 days
Tensile Strength PSI	2550	3000	3200	2900
Hardness Shore "A"	40-45	55-60	65-70	75-80
Flame Resistance	Do not support combustion			
Water Absorption %	−1.4	+0.4	+0.9	+0.75
Chemical Resistance	Good	Very Good	Very Good	Good

All tests made on Standard #8 Tubing.
*1 minute immersion in molten solder at 450°F.
**Rapid flattening between jaws of a vise to thickness of twice the wall.

USES

FT-10: Battery drain, pilot relief, window channels, mechanical rubber goods. (Lowest Temperature.)

FT-11: To facilitate circuit and wire code identification, sealing cable ends, conduit, sheath. (Transparency, Low Temperature, and Good Dielectric.)

FT-22: Sheath, sleeving insulation, communications and mechanical rubber goods. (Highly Versatile.)

FT-33: Transformer, communications and electrical manufacturing. (Baking and Soldering Temperatures.)

Sizes: From B.&S. #24 (.021" I.D.) to 2.000" I.D.—Special sizes on request.

Write for Complete Test Methods and Data—Samples

rigid & flexible

SYNFLEX

INDUSTRIAL SYNTHETICS CORPORATION

rods · tubes · shapes

60 WOOLSEY STREET, IRVINGTON, NEW JERSEY

WASHINGTON ROUND-UP

Current news, Government orders and regulations affecting the plastic industry, with analysis of the plastic situation

GOVERNMENT SUBSIDIZED SYNTHETIC RUBBER IN COMPETITION WITH PRIVATE INDUSTRY

The vinyl resins industry may soon become the first war victim of a government subsidized competitor. The industry has expanded plants and spent hundreds of thousands of dollars in product and process research, largely to help meet the rubber crisis in which this country found itself immediately after December 7, 1941. Some of this work was done voluntarily and much more at the urging and request of WPB. So vital were the vinyl resins to the war program that those who know say it was easier to get crude rubber for many uses than it was to obtain the vinyl resin "substitutes." With all of their plant facilities completed and uses established, the vinyl resin producers woke up one morning to find their markets in jeopardy. Here's how. Vinyl resins sell in a price range from 40 to 85 cents a pound. The production costs of the various synthetic rubbers including Buna S, Neoprene and butyl rubber range over a wide arc, depending on the plant in which they are made and the source and price of the raw materials. Because crude and synthetic rubbers are used interchangeably in many pieces of war equipment, such a variety of price structures would create an enormous bookkeeping job for the Army and the Navy, as well as their contractors, subcontractors and renegotiators. The simple solution to this apparently insurmountable problem was to peg the prices of all synthetic rubbers at the Government subsidy price level for crude rubber from our stock piles. However, the subsidy price for synthetic rubber at which all contracts and procurements will be figured is not the actual price. The service branch which receives the final product must refund to the Rubber Reserve Co. the difference between the subsidy price and the actual price. In most cases this means a cash refund of about 17½ cents a pound.

In the case of synthetic rubber sold for civilian uses, the Rubber Reserve Co. sells Government rubber at approximately 17½ cents below cost price, and this must eventually be made up by the taxpayer, including the manufacturers of vinyl resin, who thus is contributing to the welfare of his closest competitor. This bit of fiscal sleight of hand leaves the vinyl resin producer out on a long and slippery limb. The resin producers still hold to the old-fashioned and probably outmoded methods of selling their product. They naïvely insist on charging regular prices which include actual costs of raw materials, labor, plant amortization, depreciation and even a profit. But Government procurement officers and contractors generally look at the low price quoted for synthetic rubber and hastily conclude that it is less than a competing vinyl resin price. They do not always realize that the Government itself makes up the difference between the quoted price and the subsidized price by paying the difference to the Rubber Reserve Co. Thus a Government officer may pay 27½ cents for a certain type of synthetic rubber and think that is rock bottom. But the Government has guaranteed a price of, say, 42 cents, so Uncle Sam forks over 17½ cents more from another pocket. The total cost to Uncle Sam is then 42 cents. Some type of vinyl resin might well have been sold at the same or lower price, but the producer's ability to bargain is ruined because the procurer thinks he is getting rubber at 27½ cents.

Of course, there is no question of the need for automobile tires, but why should synthetic rubber be subsidized to compete with vinyl resin for other purposes? The plastics industry is asking for no favors, only a chance to compete on equal terms with the various related materials which are fortunate enough to be classed as "synthetic rubber" and, therefore, included in the Government subsidy program. So long as the faintest vestige of a rubber shortage exists, there should be a place for all suitable materials in war production and in the civilian economy. When our supply of synthetic rubber reaches a point where it is available for all takers, then certainly subsidies should be removed, at least to the extent that they compete with private industry.

The apparent ease with which new equipment is forthcoming when the magic name of synthetic rubber is mentioned is also more than a little puzzling to the plastics industry. Ask any molder who is down to his last roll of baling wire with which to hold his presses together. He'll tell you how difficult it is to get an approval for a new press or any other piece of necessary production equipment. To be sure, many thermoplastic machines are still on essential civilian equipment. But rubber machines, too, are processing such things as ice packs, shoe heels, garden hose and the like. If they can have part of William Jeffer's requested $95,000,000 for new equipment, which no one believes will be used exclusively for tires, what's wrong with making new machines available for plastics?

It appears that the rubber industry will very likely come out of the war period with new plant facilities complete from the janitor's broom to the general manager's gobboon. The plastics industry, on the other hand, stands a good chance of having a large majority of its machines and equipment collapse into a pile of assorted nuts, bolts and rivets. What we are really arguing for is that the same rock-bottom approach to plant facilities that has been applied to the plastics industry also be applied to the rubber industry and any other major production facilities on which the war has placed unusual demands.

TIGHTENED CELLULOSE ACETATE ALLOCATION

Cellulose plastics users asked for 460 percent of the industry's production capacity in September. Every plastics-wise person in Washington knows why. The inflated demand came because many molders placed large orders with every supplier in the hope that the total amount received would equal their original request. The total request for lipstick containers, combs and buttons would have been sufficient for about 6 months' production. WPB made an effort to meet that situation by sending telegrams to all suppliers directing them to notify their customers that, henceforth, no person may place purchase orders with one or more suppliers for more material than he can process in a 30-day period. Molders who place multiple orders instead of concentrating on their one or two suppliers are handicapping the industry. Why? If the industry asks only for the actual material it needs, there will be more left for such utility civilian goods as combs, buttons, buckles, cosmetic containers, etc.

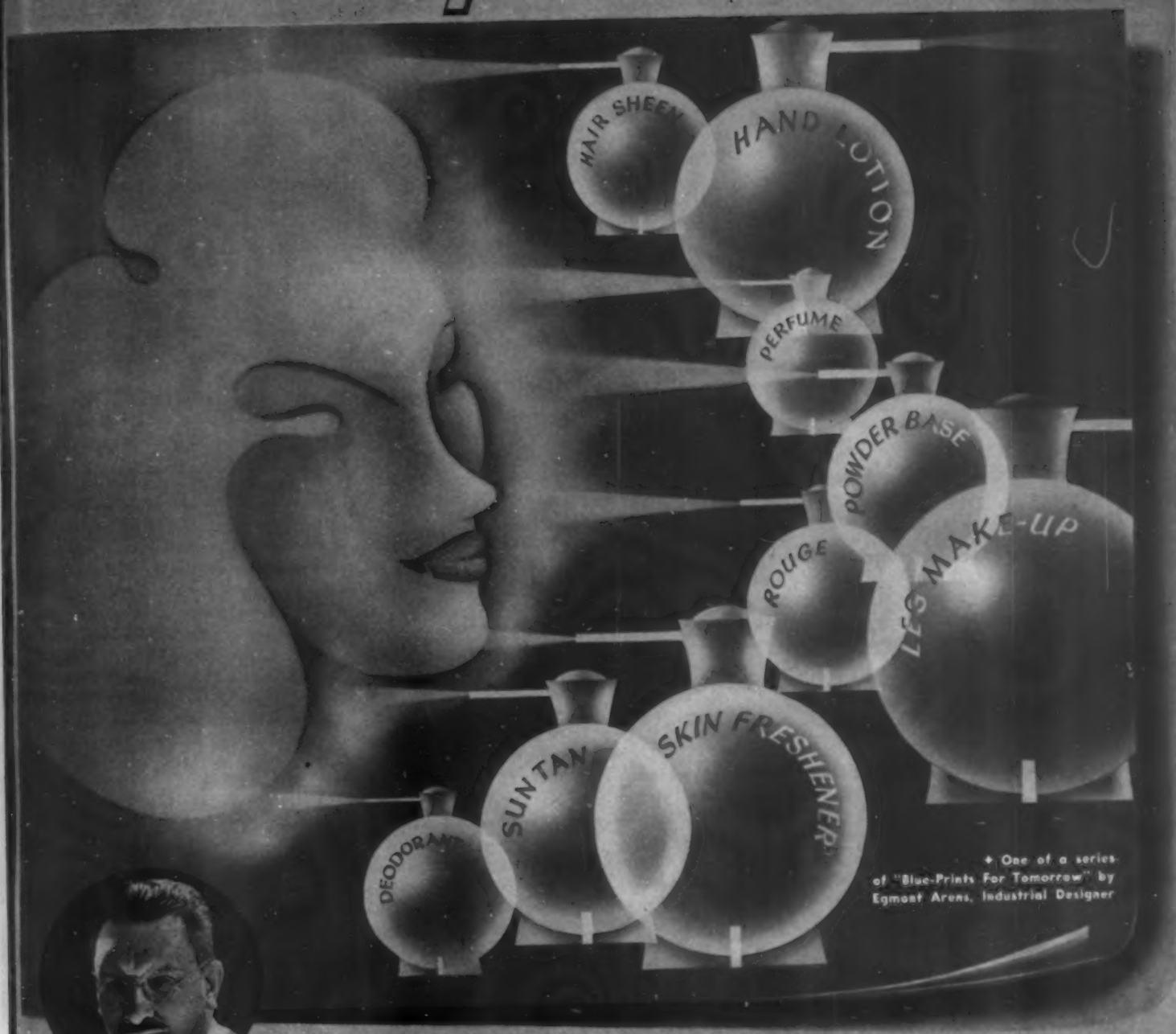
WPB took drastic steps to meet the inflated order situation on Sept. 23 by denying allocation requests to 14 molders who had placed orders for 4,000,000 lb. of material despite the fact that they had capacity for only 1,500,000 pounds. These molders will be required to revise their requirements downward before their allocations for raw material will be reconsidered. WPB officials point out that much greater quantities of cellulose plastics can be made available for good civilian usage if molders will ask only for the actual quantities needed.

INDUSTRY PRODUCES ON TIME

Production of war implements has not in any instance been delayed as a result of poor deliveries of required plastic components, according to the Thermosetting Industry Advisory Committee members who met in Washington last month. They said, however, that careful planning all along the line has been necessary to prevent interference with the output of end products, and they expressed a strong belief that reserve inventories have been liquidated to the point where additional manpower will be required if future difficulty is to be avoided.

The possibility of increased production by modernizing obsolete equipment was suggested. It was felt that available steel and other critical materials could be used to better advantage in this way, rather than in the production of such new facilities as molding presses. The Government presiding officer reported that

Beauty WITH A LIQUID SPRAY



✦ One of a series of "Blue-Prints For Tomorrow" by Egmont Arens, Industrial Designer

Designer Egmont Arens predicts for Columbia readers that *liquid* make-up will be science's contribution to post-war femininity. By the same process that now inflates a rubber life raft or life preserver from a tiny capsule, it will be possible after the war to spray liquid cosmetics, not only on the legs, but on milady's face, hands and underarms, as well. Columbia plastics will then play an important part in this new art of applying "beauty with a liquid spray" by molding the liquid cosmetics containers.

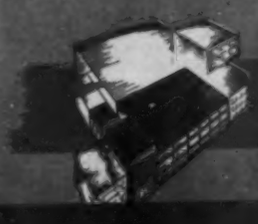
Columbia has long had a "knack" and "know-how" in plastic cosmetic containers and closures. For the enterprising manufacturer who decides to go "liquid" in cosmetics after the war, Columbia experience will be on deck to tackle the problem of container styling, workability and price.

Liquid cosmetics bestir the imagination. A big idea to file . . . and remember . . . after the duration!

And Here Is Another Blue-Print for Tomorrow

Columbia's post-war plans are being readied for a great super-plant that will have a capacity far greater than ever to meet your peacetime custom-molding requirements.

BUT TODAY Columbia's facilities for injection molding are devoted to the war effort. Prime or secondary contractors on war or other essential products will find us whole-heartedly cooperative to the extent of available capacity. If you have an essential problem, call or write Columbia.



COLUMBIA

PROTEKTOSITE CO., INC. Carlstadt, N. J.

cp custom plastics

after careful consideration and thorough checking with the steel branch, compulsory scrapping of ineffective molds had been considered impractical because a very small amount of steel would be salvaged and because occasional hardship would result. It was suggested that the industry continue its program of voluntary scrappings of molds and fixtures clearly of no future use.

WALSH-HEALEY ACT VIOLATIONS

L. Metcalfe Walling, administrator of Wage and Hour and Public Contracts Division, U. S. Department of Labor, recently issued a warning to holders of government contracts under the Walsh-Healey Act, reminding them of the penalty for violations of its child labor provisions, particularly as applied to the recent exemption permitting the employment of girls from 16 to 18 under specified conditions. These conditions are as important as the age limitation and breach of any one of them makes the employer liable to damages of 10 dollars a day for each person for each breach, an amount that can in no time reach a substantial figure. Contractors often take it for granted that they are in compliance when they have met the age regulations, without giving consideration to terms under which the employment of girls is permitted. The Secretary of Labor has agreed to consider requests for modification of the conditions of employment of these girls upon application by individual companies to employ such girls for 9 hr. a day but not more than 48 hr. a week if the purpose of the longer day is to provide one shorter workday during the week.

VINYL RESINS FOR ESSENTIAL CIVILIAN USE

There should be enough baby pants and crib sheetings made from vinyl coated fabrics to supply all essential civilian requirements by December of this year according to a WPB announcement released September 7. The announcement indicated that there would be a shortage of these items until December. The announcement gave a summary of vinyl resin products now being used by the Armed Forces and in essential civilian applications, and called particular attention to the developing postwar competition between vinyl resins and synthetic rubber.

THERMOPLASTIC MACHINERY SITUATION

An uneven distribution of machinery within the thermoplastics industry was brought to light at a recent meeting of the Thermoplastic Processors Industry Advisory Committee. Several industry members engaged entirely in war production said they would be handicapped in completing war orders on schedule unless more machinery was provided. Others, who for one reason or another decided not to take a large volume of war contracts, now have machinery standing idle because molding powders for civilian products are extremely difficult to obtain. The importance of cooperation on the part of the latter in selling or leasing machinery to those engaged in war work was stressed.

Some manufacturers making military thermoplastic items have been successful in renting machinery but now find it difficult to obtain additional molds and other equipment. It was the opinion of some that new equipment should be built for those, operating entirely on production of war products, who are capable of handling greater volume. Opposed to this suggestion was the report from several members that there is more idle equipment in the industry than formerly and that many operators are retarding the war effort by continuing to work on civilian items. These men felt that the Chemicals Division should make certain that new machinery is released only to manufacturers working on war items or on highly essential civilian products. It was proposed also that WPB investigate problems of requisitioning idle equipment and equipment operating upon civilian products.

The committee indicated approval of the present allocation policy on acetate and acete-butyrate molding materials, especially the shifting of orders from one supplier to another to provide a uniform end-use pattern for all suppliers and to keep production at the highest possible level. Several members reported success with female labor in most operations. Absenteeism in many segments of the industry has been reduced to a low figure, and it was reported that as yet there has been no noticeable delay in war production because of manpower shortages. In contrast with other segments of the Chemical industry, delays in the immediate future in thermoplastics are not indicated if the present labor supply can be maintained. Difficulty in obtaining tool and die makers for building and maintenance of molds was reported.

OPA INDUSTRY ADVISORY COMMITTEE

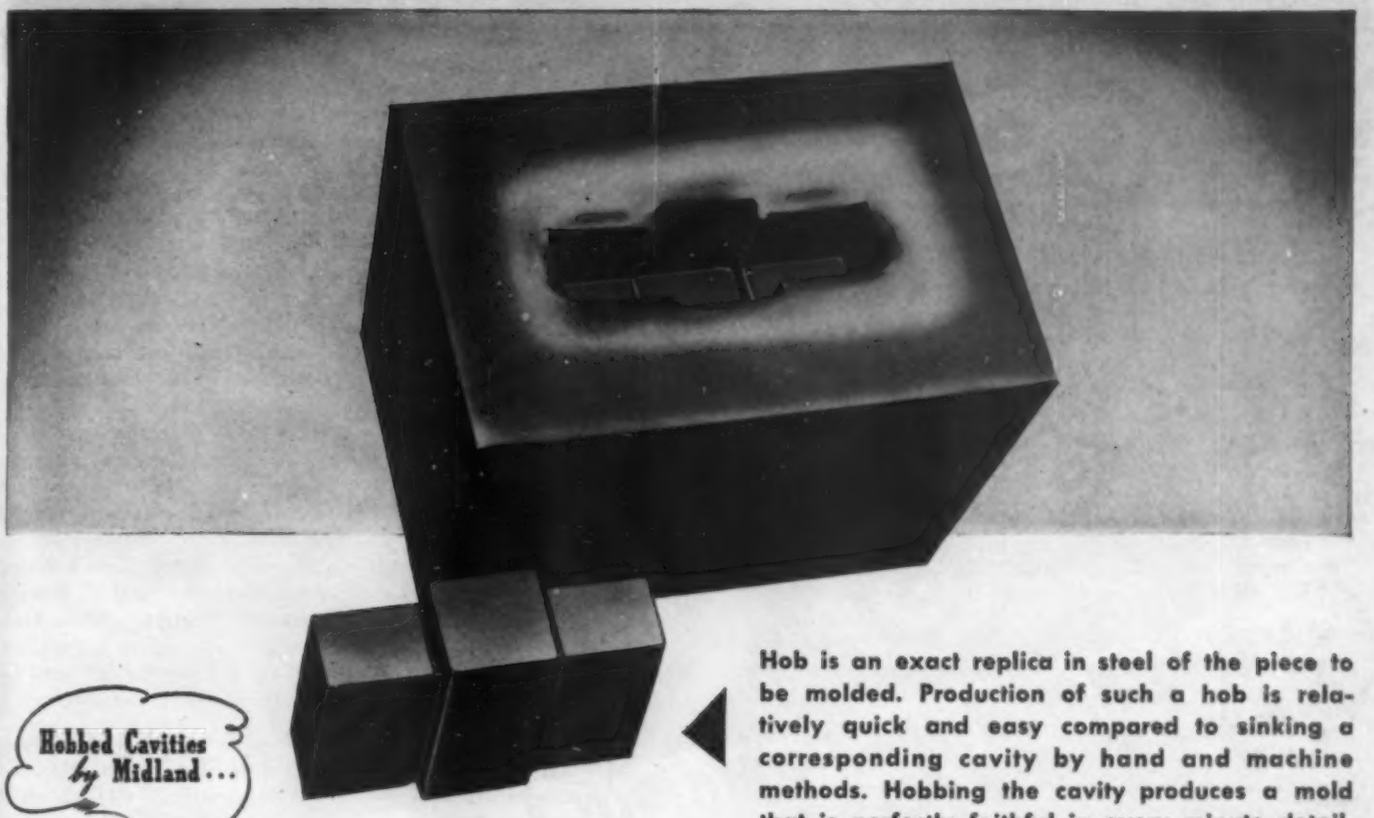
The appointment of an Industry Advisory Committee of ten members from representative plastic molders and fabricators was announced by OPA on September 2, 1943. Committee members are: K. N. Atwater, manager, Plastics Div., Pro-phy-lac-tic Brush Co.; Roy E. Berg, vice-president and general manager, Tech-Art Plastics Co.; B. F. Connor, vice-president and general manager, Colt's Patent Fire Arms Manufacturing Co.; Charles C. Livingston, vice-president and general manager, Cruver Manufacturing Co.; D. S. McKenzie, sales manager, Plastics Div., General Electric Co.; J. S. McDonald, owner and sales manager, McDonald Manufacturing Co.; V. C. Petersen, sales manager, R. D. Werner; George K. Scribner, president, Boonton Molding Co.; R. R. Titus, president, Synthane Corp.; Morris Yellin, president, Superior Plastics Co.

The committee will advise and consult with OPA on pricing problems of the industry. Plastic molded parts have been regulated up to the present time by 3 different regulations, namely: Order-229, which is a part of GMPR; MPR-136, machinery and machinery parts; MPR-188, which covers consumer durable goods. OPA maintains that it will be easier and more practical for its office and for the molders when a new order is written putting all molded plastics in one regulation just as plastic materials were put in one all-inclusive order, MPR-406. When the new order is proclaimed, plastics thus will have 2 definite price orders that cover practically the entire plastics field. Amendments will be made to these 2 orders from time to time in a further breakdown of the field—amendments such as the proposed new pricing arrangement for laminators which will be tacked on to MPR-406. Before the new order is written, the industry should determine on some course of action that would enable them to go to OPA with a recommended pricing system. Many processors are frank to admit that they have no liking for the present method. Under MPR-136 and MPR-229, molders and fabricators are supposed to file price determining methods and maintain them at a level no higher than March 1942. In order to establish a base price, OPA froze rates that determined prices—such things as labor, overhead, profit mark-up and other costs of doing business. Under this system, molders were supposed to file their price determining methods no later than August 1942. Up to this date very few of those rates have been filed.

The top officials in OPA have more or less kept their hands off plastics in the past because there was a certain mystery about the subject, and perhaps they didn't know just what to do about it. Today there is considerable plastics activity of one sort or another in OPA. Unless the industry itself takes a more active interest in what OPA is doing about plastics, there may be most unpleasant repercussions. Among the things that need doing is immediate attention to that business of making returns on "pricing methods." If it is a "screwy" system, then steps should be taken to help adjust the situation. We have the word of a prominent OPA official that their organization would welcome advice and counsel from members of the plastic industry—not only Advisory Committee members but anyone who can make a just criticism or helpful suggestion. Furthermore this official pressed home the point that industry members themselves should be on the alert to see that when their prices are cut, a corresponding cut is likewise made in the end product.

AMENDMENT TO VULCANIZED FIBRE ORDER M-305

An amendment to M-305 (Vulcanized Fibre), effective September 1, makes the following changes: Fabricators, distributors and producers under common ownership and control may make intra-company deliveries of vulcanized fibre without specific authorization. Inventories will not be permitted to exceed 2 months' supply, but provisions (*Please turn to page 152*)



Hobbed Cavities by Midland...

Hob is an exact replica in steel of the piece to be molded. Production of such a hob is relatively quick and easy compared to sinking a corresponding cavity by hand and machine methods. Hobbing the cavity produces a mold that is perfectly faithful in every minute detail. This block is shown right from the press, before machining top surface.

See what we mean when we advise

HOBBED CAVITIES?

The hobbed cavity is a powerful factor in the development of the plastic industry. On multiple cavity jobs it is the obvious method for insuring uniformity in every detail, as well as to effect huge economics in time and effort.

And for many designs, hobbing offers the only method of producing a satisfactory, one piece mold.

In the job illustrated above, the sharp corners, the perfectly flat sides, the groove separating the central from the side portions, are all produced with ease in the hob, and faithfully transferred, by hobbing, to the block. To create this cavity in a one piece block, by direct hand and machine work would be highly impractical, if not absolutely impossible.

Hobbing is Our Specialty

Controlling the behavior of the steel during the hobbing operation calls for highly specialized knowledge and skill. ("It's easy when you know how!") At Midland we have the equipment and experience to produce every form of mold or die for plastics or die cast metal.

Our exceptional success in perfecting extra deep or intricate hobbed cavities has resulted in making this work a specialty with us. We invite inquiries from die makers as well as from molders and manufacturers, on any phase of die or mold construction. Let us help you plan your post-war production program . . . in plastics!

D&E

MIDLAND DIE AND ENGRAVING COMPANY

1800 W. BERENICE AVENUE . . . CHICAGO, ILLINOIS

Makers of Plastic Molds • Die Cast Molds • Engraved Dies • Steel Stamps • Hobbings • Pantograph Engraving

IN THE NEWS

★ CHARLES A. HIGGINS, PRESIDENT OF HERCULES Powder Co., Wilmington, Del., has announced the election of Philip B. Stull as vice-president and the appointment of Ralph B. McKinney to succeed Mr. Stull as general manager of the Paper Makers Chemical Department.

Dr. John H. Long has been named to head the newly established Sales Research Div., which will investigate new markets for the company's chemical products and study the needs of industries served by the company.

★ THERMOID CO. HAS MADE ARRANGEMENTS TO acquire control of Joseph Stokes Rubber Co., Trenton, N. J., and its Canadian subsidiary in Welland, Ontario, through purchase of 97 percent of the capital stock of the parent company.

★ VULCANIZED RUBBER CO., NEW YORK, N. Y., HAS announced the appointment of Hilda Pfister as assistant advertising manager in charge of printing and direct mail.

★ A COURSE ON "TECHNOLOGY OF RESINS AND Plastics" is included in the curriculum of evening graduate courses being offered by Polytechnic Institute of Brooklyn, 99 Livingston St., Brooklyn, N. Y., for the 1943–1944 session. Registration will extend from Sept. 20 to Oct. 1, and applicants are requested to have transcripts of their undergraduate records sent to the Graduate Office before registration. All classes, which start during the week beginning Oct. 4, will be held in the Institute buildings at Borough Hall, Brooklyn, N. Y. For further information address Dean Erich Hausmann, Polytechnic Institute of Brooklyn, at the address given above.

★ BUFFALO FOUNDRY & MACHINE CO., BUFFALO, N. Y., has acquired the entire line of DOPP kettles formerly built by Sowers Manufacturing Co., and has retained the engineering, manufacturing and sales personnel of the latter company.

★ RECENT RESEARCH ON THE PART OF THE U. S. Department of Agriculture has indicated new industrial uses for lactic acid. The development consists of improved methods for converting lactic acid to methyl acrylate. In the past, methyl acrylate, which has been employed in large scale experiments for the production of plastics and synthetic rubber, has been made synthetically from organic compounds. Its production from lactic acid would mean an additional outlet for farm products. Lee T. Smith and his associates of the Bureau of Agricultural and Industrial Chemistry, who are conducting the investigations, have found that the acrylic esters obtained in this process can be polymerized in mass, water emulsions or in organic solvents. Because these polymers possess a wide diversity of properties, they may find outlets in the production of adhesives, adhesive tapes, and in impregnating and coating materials.

★ THE PLASTICS EXHIBIT ORGANIZED BY MODERN Plastics magazine will be shown at G. Fox & Co., department store, Hartford, Conn., from Oct. 9 through 16. During the latter part of October this showing of plastic parts will move to the department store of Stern Co., Philadelphia, Pa.

★ PLASTIC FILM CORP. HAS OPENED NEW OFFICES at 475 Fifth Ave., New York, N. Y.

★ CALCO CHEMICAL DIV., AMERICAN CYANAMID CO., Bound Brook, N. J., has appointed Sidney C. Moody as assistant general manager in charge of all departments of the Division.

★ GLENN L. MARTIN AIRCRAFT CO., BALTIMORE, Md., has announced the development of a new substitute for rubber, a vinyl-type plastic called Marvinol. While the formula of the product was kept secret, it was said to be composed of plasticizer, sealant, resin and a toughening agent. According to Glenn L. Martin, president of the company, the plastic is expected to revolutionize the production of automobile inner tubes and numerous other articles made of natural rubber. The aircraft company is prepared to undertake immediate large-scale production and to license rubber manufacturers designated by the government to make inner tubes of the new substance.

The secret of Marvinol is said to lie in the plasticizer which gives the plastic its rubber-like quality. Discovered by 2 members of the Martin plastics-research laboratory, the plastic is understood to have demonstrated its superiority to both natural and synthetic rubber for such products as inner tubes, elastic gloves used in hospitals, and a number of industrial and household products. According to Mr. Martin, Marvinol has "absolute impermeability," eliminating any seepage of air through the sidewall of the tube and, consequently, making it unnecessary for motorists to check tire pressures. Another advantage attributed to inner tubes made of this new substance, is that they are reclaimable. For hospital gloves Marvinol is credited with having extremely high resistance to alkalis and acids, and of showing great resistance to abrasions, snags and tearing. While Marvinol will be limited for the duration of the war to inner tubes, gloves and certain aircraft parts, after the war it may be used for hot-water bottles, heels for shoes, pencil erasers, raincoats, etc.

★ W. H. RICHARDSON, FORMER ASSISTANT GENERAL sales manager of Timken Roller Bearing Co., Canton, Ohio, has been appointed general manager of all activities of all divisions of the company on the entire West coast and in the Orient. Mr. Richardson will be in charge of the sale and mechandising of roller bearings for original equipment and for replacement purposes, and also will supervise sales of steel and tubing, and the company's rock bits.

★ JAMES H. RHODES AND CO., CHICAGO, ILL., AND Long Island City, N. Y., announce the appointment of Scott A. Silliman as assistant sales manager. Mr. Silliman formerly was in the employ of Stewart-Warner Corp., as the company's contract sales manager.

★ CHICAGO CHAPTER OF SPE HELD ITS FIRST ANnual golf tournament on August 13 at Tam-O-Shanter Country Club. John Deer, Sinko Tool & Mfg. Co., won the trophy—a plastics piece made by Cardinal Corp. In addition to the 50 members who turned out for golf, approximately 100 were present at the dinner which followed the tournament.

★ UNDER THE NAME OF J. M. LITTLE AND ASSOciates, J. McLeod Little has formed his own industrial design organization at 801 Security Building, Toledo, Ohio. Mr. Little was a former partner in the firm of Harold Van Doren and Assoc.

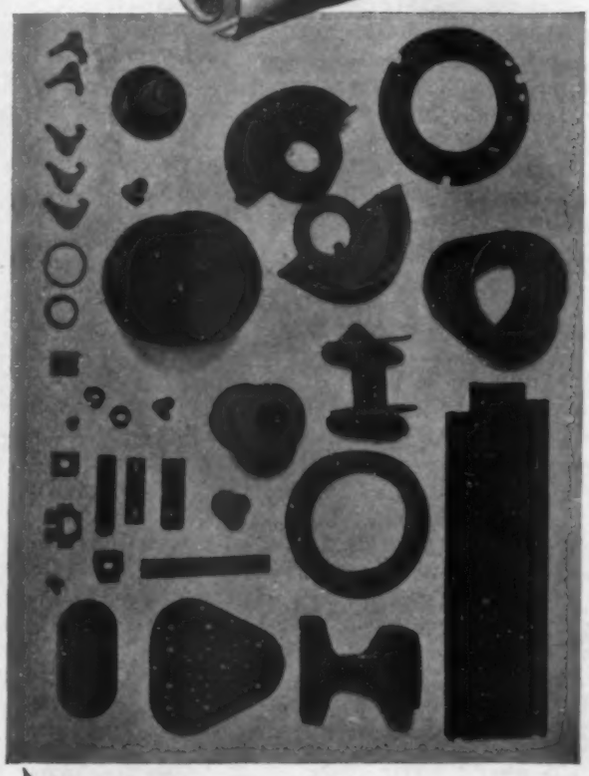
★ JOHN J. NIELSEN HAS BEEN NAMED PLASTICS specialist for the Los Angeles area by Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., in order to facilitate customer service in the Southern California region.

★ DOW CHEMICAL CO., MIDLAND, MICH., RECENTLY announced that full scale production had been achieved 6 weeks ahead of schedule on the first unit of the company's new styrene plant located at Los Angeles, Calif.

★ EDGAR L. SCHLESINGER HAS BEEN SELECTED BY United Merchant & Manufacturers, Inc., to head the company's research on new fibers and materials which may have a textile application, and to coordinate the company's technical and mechanical facilities for this purpose.

★ TWO CHANGES IN PERSONNEL AT AMERICAN INsulator Corp., New Freedom, Pa., have been announced by George A. Johns, president. Charles P. Clifford, former Boston representative, has been made sales manager, and L. V. Bollinger, assistant sales manager. *(Please turn to next page)*





When a parachutist takes his final exam both his diploma and his life depend on the fitness of his rip cord.

Lives also frequently depend upon the fitness of inconspicuous radio and electrical parts of Formica laminated plastic used in war equipment — such parts as insulating spools, insulating spacers, breaker arms, radio tube socket bases, terminal strips, rheostat cores and other insulating parts.

Formica combines lightness with strength, dimensional stability, and resistance to change through chemical action. It has a low power factor, low dielectric loss. There is a wide variety of grades each of which emphasizes some one of the many valuable properties of material for special purposes.



THE FORMICA INSULATION COMPANY

4673 SPRING GROVE AVENUE • CINCINNATI, OHIO

★ A LIST OF ALLIED MILITARY GOVERNMENT officers recently released by the Army Office of Procurement in Boston, Mass., included the name of Maj. Albert J. Gottlieb, general manager, R. B. Kingman Co. and Ben Hur Products Co.

★ N. J. L. MEGSON, CHIEF OF ADVISORY SERVICE ON Plastics and Rubber of the British Ministry of Supply, has returned to London after a 6 weeks' survey of plastics developments in the United States. This was the first official mission from Great Britain on plastics and has served to further the exchange of information on materials, military applications and specifications between the two countries. It is anticipated that the close relationships which have been established between the plastics branches of these two governments by the official visit of Mr. Megson and by that of Dr. G. M. Kline, National Bureau of Standards, to Great Britain one year ago, will be extended to include the official plastics agencies of others of the United Nations.

★ A JOINT MEETING OF THE ENGINEERING INSTITute of Canada and the American Society of Mechanical Engineers will be held at the Royal York Hotel, Toronto, Canada, Sept. 30 through Oct. 2. Of special interest to the plastics industry is the address on "Plastic Plywoods in Aircraft Construction," by R. D. Hiscocks, engineer-in-charge, Structural Laboratory, Aeronautical Div., National Research Council, Ottawa, Canada, scheduled for Saturday morning, Oct. 2. Conferences will be held simultaneously with the sessions in order to provide an exchange of ideas. A meeting on plastics is planned for Oct. 1 at 2:30 p.m., and one on synthetic rubber for Oct. 2 at 10 a.m. Arrangements for both these conferences for the U. S. group are in the hands of G. M. Kline, chairman, and E. F. Reising, vice-chairman of the A.S.M.E. Rubber and Plastics Group.

★ NORTHERN FURNITURE CO., SHEBOYGAN, WIS., has announced plans for an investment of approximately $750,000 to enable the company to go into plastics work and metal stamping immediately after the war with a payroll of from 300 to 400 additional employees. The projected plants will operate in conjunction with a considerably expanded furniture factory.

★ ANNOUNCEMENT HAS BEEN MADE OF THE APpointment of V. C. Petersen as vice-president of R. D. Werner Co., Inc., New York, N. Y.

★ R. J. MARSHALL, PRESIDENT, HAS ANNOUNCED the change in his firm's name from Pump Engineering Service Corp., to PESCO Products Co., Cleveland, Ohio. The change was suggested by the fact that PESCO, the concern's trade name, was in wider use within industry than the older, longer name.

★ WORD HAS BEEN RECEIVED OF THE DEATH OF Hugh A. Todd, New York State representative of Hanson-Van Winkle-Munning Co.

★ AIRPLASTICS CO., HUNTINGTON PARK, CALIF., has announced the appointment of Walter W. Weaver as general manager. The post formerly was held by H. R. Peck, co-owner. Floyd Eichelberger succeeds W. H. Mentz as shop foreman.

★ A WHITE STAR SYMBOLIZING RENEWAL OF THE Army-Navy "E" award was presented to the workers of Formica Insulation Co., Cincinnati, Ohio, on September 8.

Sorry!

★ IT HAS BEEN CALLED TO OUR ATTENTION THAT IN the article on "Molded dairy equipment" which appeared in the September issue on page 80, we failed to mention that the cone-shaped skimming discs are made from Kraft Resin-X-Crepe.

★ THROUGH ERROR, AUBURN BUTTON WORKS, INC., was not listed as the molder of the film spools described in item 7, page 85, in our September issue.

★ IT HAS BEEN CALLED TO OUR ATTENTION THAT in the article "Low Pressure Molding of Laminates" which appeared in the August issue on page 57, credit should have been given Crosley Marine for photographs 10, 12 and 13 showing an experimental wing tip faring, a streamlined antenna housing and a radio lacquer case.

★ MOVING FROM STATE TO STATE AND ON INTO Canada, the color and sound film, *This Plastic Age*, produced by MODERN PLASTICS magazine, has had approximately 300 showings, a schedule which represents only about three-quarters of the demand. In many cases the film served to introduce audiences to plastics and its uses. Everywhere it has been met with keen interest and enthusiasm.

Among the groups that have seen this film are Chapters of such technical societies as the Society of the Plastics Industry, Society of the Chemical Industry, American Society of Tool Engineers, American Society of Mechanical Engineers and American Electroplaters Society. Other showings were given before members of the E.S.M.W.T. and visual education departments of colleges and universities; clubs such as Kiwanis, Rotary, Y.M.C.A., Masons and Lions. Technical clubs in the fields of advertising, houseware, plastics, rubber and paint also have seen the film, as have foremen and engineers' clubs; chapters of business, educational and industrial associations and organizations. This latter group included dealers in paper, lumber, paint and pipe fittings. The film also was widely sponsored and reviewed by war plants, plastic materials manufacturers, molding plants, museums of art and science, research laboratories, a Special Service Depot, a Signal Corps laboratory, a Navy Yard and an Army Air Depot.

Through the cooperation of the Plastic Industries Ltd. it was possible to answer the demand for Canadian showings of the film. Held in custody by this company, the film was screened for groups similar to those that saw it in the United States.

The splendid color photography and general artistry of the film were appreciated and commended heartily by all groups and, significantly, by a department of Paramount Pictures and Wilding Picture Productions. Comments on the educational value of the film also were very complimentary. For example, Kansas Industrial Development Commission wrote: ". . . this probably could be the most valuable piece of educational material that has reached Kansas in a long time." In support of this opinion the Commission purchased a duplicate print of the film for distribution in Kansas. The Department of State approved the purchase of a special Spanish version for use by the Coordinators of Inter-American Affairs and later further requested a print for distribution among technical and educational groups in China.

The American Institute of Mining and Metallurgical Engineers wrote: "You have succeeded in embodying within the realm of color photography at its best one of the finest surveys on plastics that it has been our pleasure to witness." The Aircraft Division of H. J. Heinz Co. commented, "It was the general consensus of opinion that *This Plastic Age* gives an excellent background of the entire plastic field."

The demand for *This Plastic Age* seems to increase with each showing. At present, bookings extend far into 1944. A 6 weeks' advance notice has been the average requirement for obtaining this film. Listed below are some of the representatives who have reserved the film for the remaining months of this year. Anyone desiring to attend one of the showings probably could make the necessary arrangements with the individuals or groups listed.

October 1–15, H. Paul Lary, Ford Airplane School, Willow Run Bomber Plant, Ypsilanti, Mich.; Oct. 11–23, Capt. Myles F. Costello, Special Service Office, Headquarters Selman Field, Monroe, La.; Oct. 16, Dorothy Thornton, School Art League of New York, 110 Livingston St., Brooklyn, N. Y.; Oct. 22, Dr. J. O. Ellsworth, Dean of Commerce, Texas Teachers College, Lubbock, Texas; Oct. 28, R. R. Sprole, Therm-Electric Meters Co., Ithaca, N. Y.; Oct. 28, J. E. Allen, The ARO Equipment Corp., Bryan, Ohio; Oct. 29, School of Store Service Education, Div. of Richmond Professional Institute, College of William and Mary, Richmond, Va.; Nov. 2, W. W. Weber, Div. of Information and Education, Forest Products Laboratory, U. S. Dept. of Agriculture, Madison, Wis.; Nov. 5, Joseph C. Feagley (Rotary Club showing), Armstrong Cork Co., Lancaster, Pa.; Nov. 8, George C. Wilcox, Association of Mfgrs' Representatives of Maryland, 211 E. Pleasant St., Baltimore, Md.; Nov. 9, Clayton Shoemaker (S.P.I. meeting), Dow Chemical Co., 30 Rockefeller Plaza, New York City; Nov. 11, D. P. Brewer, Purchasing

PROGRAM

Annual Fall Meeting

SOCIETY OF THE PLASTICS INDUSTRY

November 8, 9, 1943, Waldorf-Astoria Hotel, New York City

Sunday, November 7th: 7:00-9:00 P.M.—Registration

Monday, November 8th:

9:00-10:30 A.M.—Registration

10:30-12:00 A.M.—Meeting—Jade Room—Howard Bunn, presiding.

Speakers: Dr. Dinsmore—"Synthetic Rubber"
James Bailey—"Extruding Polystyrene"

12:30-2:00 P.M.—Luncheon—Grand Ballroom—George Scribner, presiding

Speaker: Hon. Fiorello H. LaGuardia, Mayor of the City of New York

2:30-4:00 P.M.—Meeting—Grand Ballroom—Allan W. Fritzsche, presiding

Speakers: Eric A. Cammon—"War Contract Termination"
Alden B. Dow—"Plastic in House of the Future"

4:00-5:00 P.M.—Group Meetings

Button Group—	Rooms
Neal O. Broderson, Chairman	4W
Molders Group—	
James B. Neal, Chairman	4XY
Extruders Group—	
Elmer Szantay, Chairman	4JKL
Machinery Gorup—	
Carl Hitchcock, Chairman	4M
Canadian Group—	
A. E. Byrne, Chairman	4NP

6:00-7:00 P.M.—Pioneer group meeting—Jade Room—Chairman, H. S. Spencer

7:30 P.M.—Dinner—Grand Ballroom—Ronald Kinnear, presiding.

Speaker: Quentin Reynolds (two topics)—"With American Forces in Sicily and Italy"; and "Russia Today".

Tuesday, November 9th:

10:00-12:00 A.M.—Meeting—Jade Room—E. B. Crawford, presiding.

Closed meeting for S.P.I. members only.

Speaker: Charles Livingston—"Post War Planning"

12:30-2:00 P.M.—Luncheon—Grand Ballroom—A. E. Byrne, presiding.

Speaker: S.P.I. Business Meeting

2:30-4:00 P.M.—Meeting—Grand Ballroom—James Rodgers, Jr., presiding

Speakers: Dr. Stamm—"Wood and Paper Base Plastics"
Ralph Ball—"New Cellulose Derivatives"

4:00-5:00 P.M.—Group Meetings

Thermosetting group

Thermoplastic group

Resin Adhesive group

5:00-6:00 P.M.—Cocktail party by Powder manufacturers—Sert Room

7:30 P.M.—Dinner—Grand Ballroom—George Scribner, presiding.

Speaker: To be announced later. Will be important national figure.

PLEASE MAKE YOUR RESERVATIONS EARLY—MAIL DIRECT TO

SOCIETY OF THE PLASTICS INDUSTRY

295 Madison Avenue, New York, N.Y.

N.B. It is suggested that travel reservations be made on a round-trip basis and well in advance, since it is extremely difficult to reserve train space at the last minute from New York.

Agents Assoc. of Washington, c/o Trumbull Electric Mfg. Co., Seattle, Wash.; Nov. 16, Harriet Raymond, Celanese Celluloid Corp., 180 Madison Ave., New York City; Nov. 27–29, E. W. Vaill (A.S.T.E. meeting), Bakelite Corp., 410 Asylum St., Hartford, Conn.; Dec. 3, M. S. Curtis, The Youngstown Sheet and Tube Company, Youngstown, Ohio; Dec. 13, E. P. Harrison, Rochester Ad Club, 128 Powers Hotel, Rochester, N. Y.

However, there are additional bookings open for you and your organization. You can prepare a vital and timely discussion or lecture built around this interesting and instructive film.

★ JOHN S. BARNES CORP., ROCKFORD, ILL., HAS opened an Eastern sales office at 250 W. 57th St., New York, N. Y., under the supervision of E. C. Hawkins. Mr. Hawkins formerly was chief engineer of LeMaire Tool & Manufacturing Co. Henry G. Hoss has been appointed sales representative for Barnes hydraulics in Indiana.

★ G. V. KULLGREN HAS BEEN APPOINTED TO THE Akron, Ohio, office of Farrel-Birmingham Co., Inc., Ansonia, Conn., and Buffalo, N. Y. Mr. Kullgren formerly was associated with General Electric Co.

★ E. L. FEININGER, MANAGER, RESIN AND INSULAtion Materials Div., General Electric's Appliance & Merchandise Dept., has reported the removal of the sales and order service of his division from Bridgeport, Conn., to Schenectady, N. Y.

★ DR. ALBERT FIEDLER HAS BEEN MADE DIRECTOR of Research for Milburn Co., Detroit, Mich. Dr. Fiedler, who will be in charge of a newly enlarged laboratory, formerly was affiliated with the Technical and Research Dept., Annobolic Fords, Inc.

★ JOHN C. BROOKS, VICE-PRESIDENT OF MONSANTO Chemical Co., has announced the approval by WPB of the construction of additional manufacturing facilities at the company's Springfield, Mass., plant for Resinox phenolic resins and molding compounds. The increased capacity will be devoted entirely to high-priority war applications.

★ MALCOLM FARMER HAS BEEN APPOINTED VICEpresident and general manager of Plastic Manufacturers, Inc., Stamford, Conn. Mr. Farmer previously was vice-president and general manager of Phoenix Iron and Phoenix Bridge Cos.

★ A NEW PROCESS FOR LOW-COST PRODUCTION OF industrial alcohol based upon the use of sodium sulfite, a formerly discarded by-product of woodpulp, coke and other industries, has been announced by Carl J. Kiefer, vice-president in charge of production at Schenley Distillers Corp., New York City. The firm's Green River distilling plant has been selected by the Office of Research Production and Development of WPB for the conduct of experiments to determine the feasibility of commercial use of the process.

★ WITHIN 3 TO 5 YEARS AFTER THE WAR THE PLAStics industry will pass the billion-dollar mark in sales volume "strictly within itself," according to G. Guy Jeter, consulting plastics engineer, who was the principal speaker at the first fall meeting of the Plastics Club of America held at the New York Advertising Club on Sept. 14. "Plastics will expand in many fields, particularly in those of packaging, merchandising, home furnishings and building construction," Mr. Jeter said. He warned, however, that new applications to be sound must be predicated on sound engineering principles. His speech illustrated with 7 large charts, was followed by the MODERN PLASTICS film, "This Plastic Age."

The next meeting of the club will be held on Oct. 19 at the Hotel Pennsylvania in conjunction with the Housewares Club of New York. Officers for the coming year will be elected at the November meeting, on the 9th of the month, which also will be held at the Hotel Pennsylvania. The speaker of the evening will be announced at a later date. The December meeting will be addressed by John K. Honish, Bakelite Corp. The annual banquet and inaugural ball will be held on Jan. 15. Tickets will be $7.70.

(*Please turn to page 154*)

S.P.I. News

The Committee on Arrangements for the Fall meeting of SPI to be held November 8 and 9 at the Waldorf-Astoria, New York City, has been driving hard, and the program is very nearly crystallized. In accordance with wartime practice, business will be the order of the day, and no arrangements are being made for the entertainment of the members. It has been suggested that hotel reservations be made as early as possible. There are still a few empty places on the speakers program but enough already is known of the agenda to give a fair idea of the scope and importance of the conference. Quentin Reynolds, Collier's war correspondent, will be the principal speaker at the dinner on Monday, Nov. 8. Mr. Quentin whose latest book is "Dress Rehearsal," has just returned to the United States after 6 weeks with our troops in the Mediterranean area.

Dr. R. P. Dinsmore, vice-president of Goodyear Tire and Rubber Co., will be the first speaker on the program. He will be introduced by Howard Bunn, SPI vice-president, who is to preside over the opening session scheduled to convene at 10:30 a.m. on Monday, November 8. Dr. Dinsmore will speak on "Synthetic Rubber," a subject closely akin and of vital interest to the plastics industry. Following Dr. Dinsmore's address, the conference will hear from James Bailey of Plax Corp. His subject, "Extruding Polystyrene," is of particular significance because the productive capacity for styrene is being expanded so greatly and large amounts of polystyrene promise to become available to the plastics industry as soon as the synthetic rubber needs are satisfied. At the luncheon on November 8, to be presided over by George Scribner, president of SPI, the Honorable Fiorello H. LaGuardia, Mayor of the City of New York, is to hold the place of honor on the speakers' platform. Following the luncheon, the meeting will be addressed by Eric A. Cammon, member of the firm of Peat, Warwick, Mitchell and Co., accountants, on the subject of "War Contract Termination." Alden B. Dow, well-known architect, will speak on "Plastics in the House of the Future."

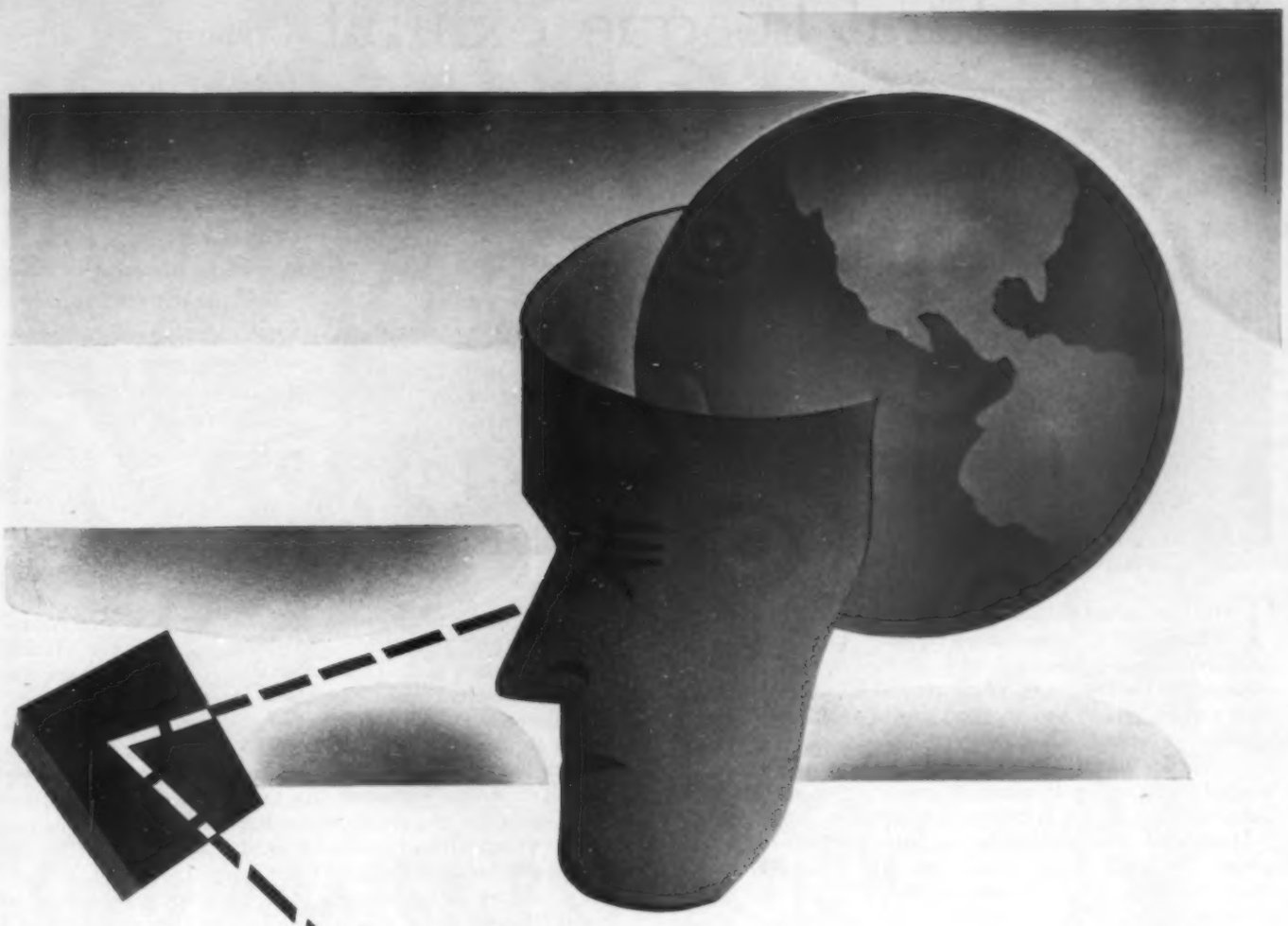
From 4:00 to 5:00 p.m. on Monday, the general conference gives way to the group meetings, presided over by their respective chairmen. Neil O. Broderson of Rochester Button Co. will open the Button session; James B. Neal of Norton Laboratories, the Molders' meeting; Elmer Szantay of Sandee Mfg. Co., the Extruders' meeting; Carl Hitchcock of Farrell-Birmingham Co., the Machinery group; and A. E. Byrne, SPI's Canadian Section chairman, the Canadian group. After the industry group meetings, the Plastics Pioneers will get together under the chairmanship of Herbert S. Spencer.

Kenneth Macksey of Mack Molding Co. is to preside over the opening session on Tuesday, November 9. This is to be a closed meeting for SPI members only. Charles Livingston, chairman of SPI's Post-War Planning Committee, is to be the principal speaker. He will outline for members the plan which is being developed for furthering plastics in the days following the war. Following the 2-hour meeting on Post-War Planning, a luncheon is scheduled in the Grand Ballroom with A. E. Byrne presiding. W. J. McCortney, chairman of SPI Technical Committee, will report on the committee's work.

Dr. A. J. Stamm of Forests Products Laboratory, United States Department of Agriculture, will speak on "Wood and Paper Base Plastics" at the Tuesday afternoon session which will be presided over by James Rodgers, Jr., president of Plaskon Division, Owens-Illinois Glass Co. There is to be a dinner meeting beginning at 7:30 p.m. on both Monday and Tuesday evening with Ronald Kinnear and George Scribner presiding on the respective days. Registration for the conference is to begin at 7 p.m. on Sunday, November 7 and will be continued from 9:00 to 10:30 a.m. on Monday, November 8.

The exhibit "Plastics Today and Tomorrow" which was arranged by Modern Plastics magazine, will be shown at the meeting in conjunction with exhibits from the Army and Navy, and from molders.

(*Please turn to page 154*)



plastics . . AND MAN'S PLANS FOR A BETTER WORLD . .

We find it inspiring to work with plastics users whose postwar manufacturing plans will contribute substantially toward a better world in which to live. We are glad to receive requests now to confer with them about their present needs and future plans involving the use of plastic moldings.

THE pyro PLASTICS COMPANY

WESTFIELD, NEW JERSEY

Architectural League exhibit



1

1—This view of the exhibit shows the plywood fuselage which faced the entrance. Small objects such as brushes and vases were displayed in the showcase at center foreground. Half of a jettison tank can be seen at the left

THE plastics exhibit sponsored by the Architectural League of New York at its headquarters, 115 E. 40th St., New York City, was opened to the public on September 6. The program as arranged by the League in conjunction with such groups as the New York chapter of American Institute of Architects, American Institute of Decorators and Designers' Research Group, included a showing of "Plastics Today and Tomorrow," the exhibit developed by MODERN PLASTICS Magazine. Numerous symposiums were conduction in conjunction with the exhibit.

The first of these symposiums was held at a luncheon on Septemper 7. "Plastics and Design" was the topic discussed by George Scribner, S.P.I.; James Rodgers, P.M.M.; and Harvey Corbett, A.I.A. The keynote of all 3 speeches was: "Learn about plastics before using. Get acquainted with the new materials before specifying." On Wednesday, several speakers held forth at the cocktail hour on "Plastics in the Postwar Home," with Miss Freda Diamond acting as moderator. Those participating in the discussion were William Leicester, Casein Co. of America; Joseph Kasper, R. H. Macy & Co.; Harriet Raymond, Celanese Celluloid Corp.; Eugene Schoen; Roy Price, Union Carbide & Carbon Co.; and Mrs. Van Wessop, Lord & Taylor, Inc. Mrs. A. Van Wessop discussed the problem of selling plastic buttons, buckles and hand bag fastenings. Some of these articles proved too cos ly in competition with other materials, she said, some not so efficient and some were acceptable in style and as supplementary decoration. Joseph Kasper also talked of merchandizing with emphasis on the general problem of sales of plastics. He cautioned against the conception of substitution, the idea of over popularity and of the danger of fad in fashion. His talk was sober and hardheaded. Before bringing the symposium to a close, Miss Diamond revealed that there was a feeling among members of the League that a central clearing house was needed for factual information about plastics.

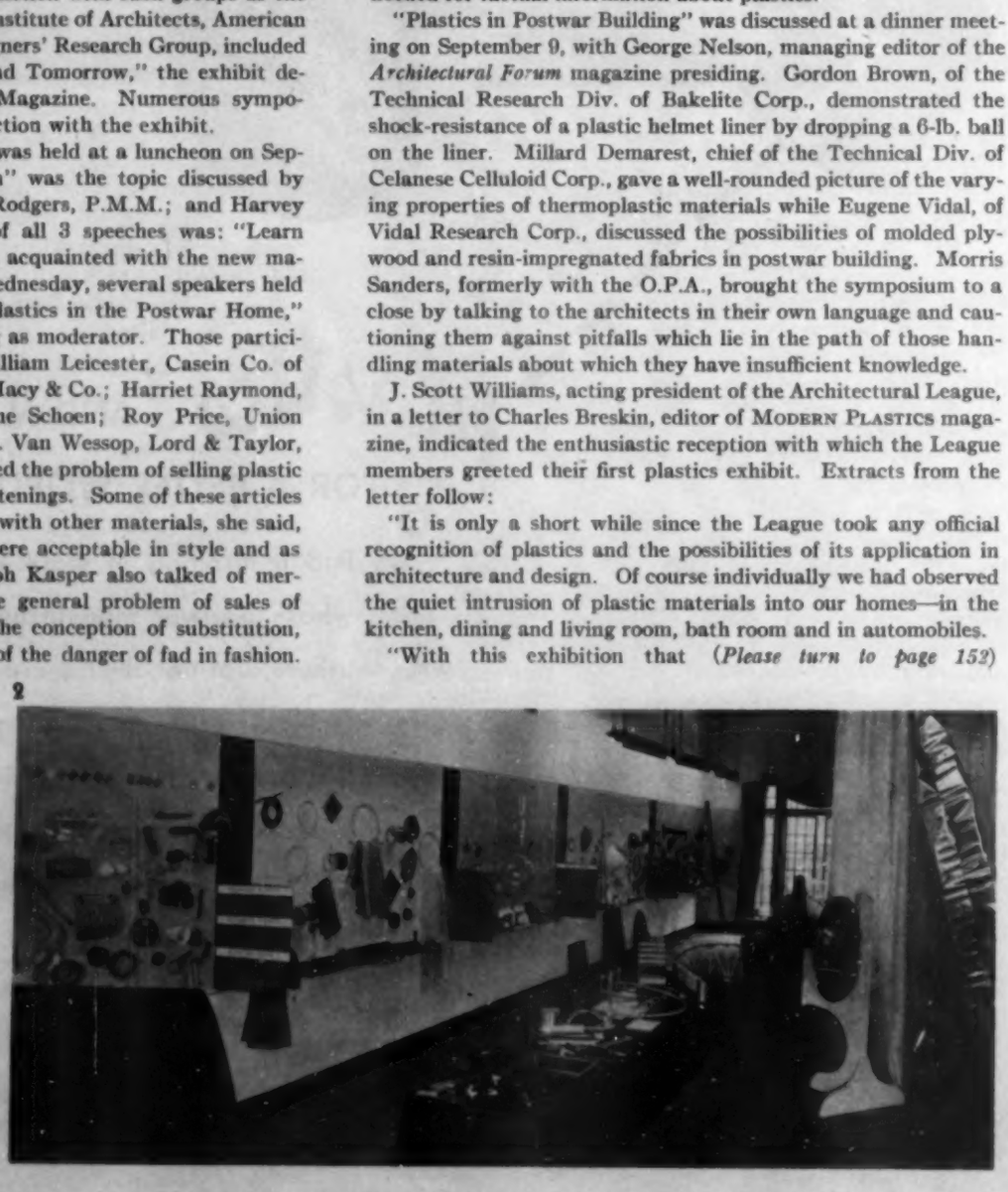
"Plastics in Postwar Building" was discussed at a dinner meeting on September 9, with George Nelson, managing editor of the *Architectural Forum* magazine presiding. Gordon Brown, of the Technical Research Div. of Bakelite Corp., demonstrated the shock-resistance of a plastic helmet liner by dropping a 6-lb. ball on the liner. Millard Demarest, chief of the Technical Div. of Celanese Celluloid Corp., gave a well-rounded picture of the varying properties of thermoplastic materials while Eugene Vidal, of Vidal Research Corp., discussed the possibilities of molded plywood and resin-impregnated fabrics in postwar building. Morris Sanders, formerly with the O.P.A., brought the symposium to a close by talking to the architects in their own language and cautioning them against pitfalls which lie in the path of those handling materials about which they have insufficient knowledge.

J. Scott Williams, acting president of the Architectural League, in a letter to Charles Breskin, editor of MODERN PLASTICS magazine, indicated the enthusiastic reception with which the League members greeted their first plastics exhibit. Extracts from the letter follow:

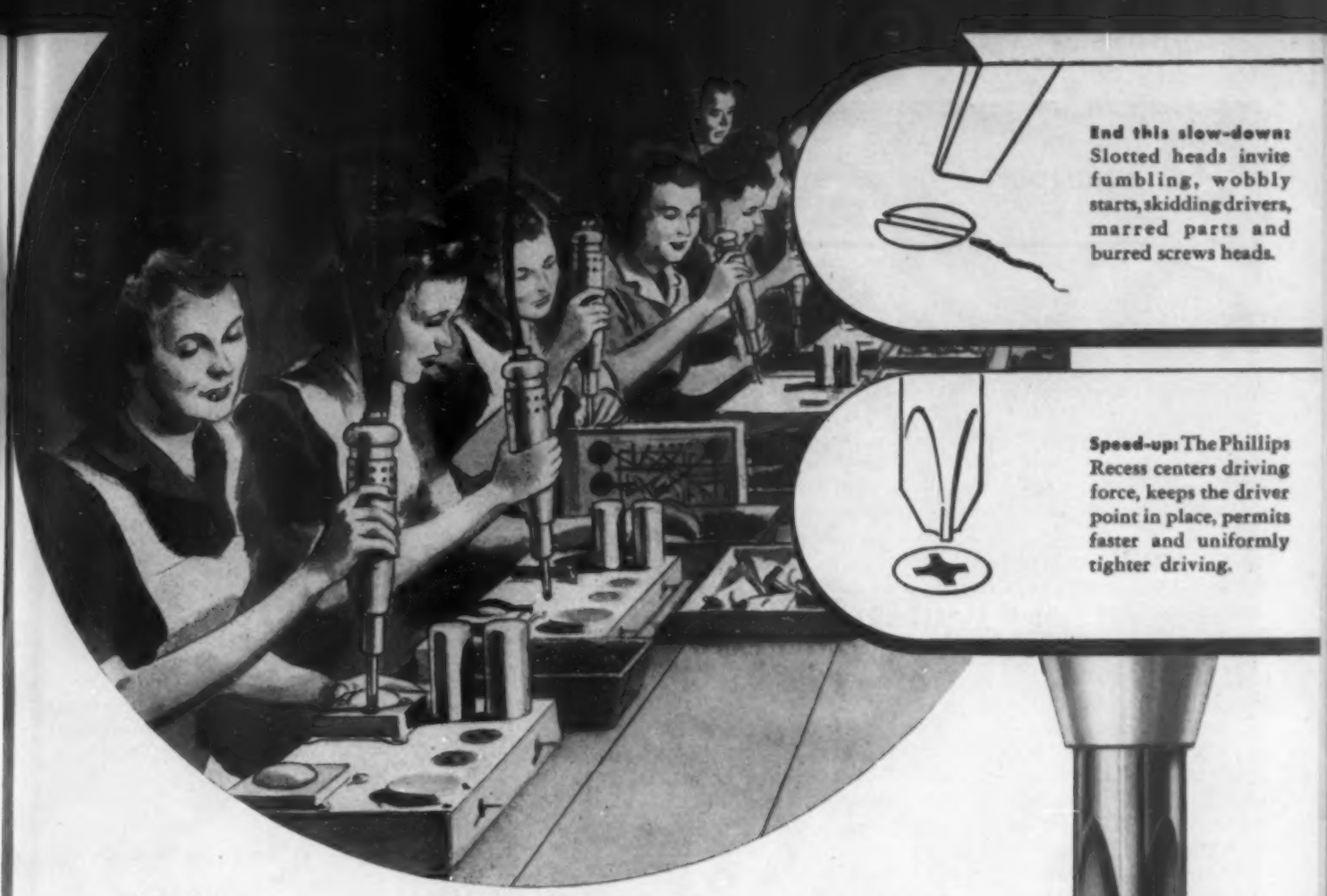
"It is only a short while since the League took any official recognition of plastics and the possibilities of its application in architecture and design. Of course individually we had observed the quiet intrusion of plastic materials into our homes—in the kitchen, dining and living room, bath room and in automobiles.

"With this exhibition that (*Please turn to page 152*)

2



2—The parts displayed on the wall at the left are of cellulose acetate, ethyl cellulose, of cellulose nitrate, styrene, acrylic and amino resins and phenolic materials



End this slow-down: Slotted heads invite fumbling, wobbly starts, skidding drivers, marred parts and burred screws heads.

Speed-up: The Phillips Recess centers driving force, keeps the driver point in place, permits faster and uniformly tighter driving.

Capture EXTRA PRODUCTION with Your Screw Driving Army

PHILLIPS SCREWS DRIVE TWICE AS FAST

Don't just *worry* about lagging production . . . *do something* about it! Boost your output by providing your assembly line with Phillips Screws – the modern speed-screw with the scientifically engineered Recessed Head! The Phillips driver automatically centers in the screw head, utilizes turning power rather than head-on pressure, eliminates the troubles that slow-up driving . . . wobbles, skids, burred screw heads. The result is speedier assembly . . . as much as 50% in some plants.

The skid-proof feature of the Phillips Recess further prevents marred parts and driver-slashed hands. Freed from fear, old timers and newcomers alike can concentrate on fast, faultless driving. Power and spiral drivers can be used to advantage. Switch to Phillips Screws and see how your screw driving army chalks up new assembly records.

Compare the cost of driving Phillips versus slotted head screws. You'll find that it actually costs less to have the many advantages of the Phillips Recess!

KEY TO FASTENING SPEED AND ECONOMY

The Phillips Recessed Head was scientifically engineered to afford:

Fast Starting – Driver point automatically centers in the recess . . . fits snugly. Screw and driver "become one unit." Fumbling, wobbly starts are eliminated.

Faster Driving – Spiral and power driving are made practical. Driver won't slip out of recess to injure workers or spoil material. (Average time saving is 50%.)

Easier Driving – Turning power is fully utilized by automatic centering of driver in screw head. Workers maintain speed without tiring.

Better Fastenings – Screws are set-up uniformly tight, without burring or breaking heads. A stronger, neater job results.



PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

21 SOURCES

American Screw Co., Providence, R. I.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
The Charles Parker Co., Meriden, Conn.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Whitney Screw Corp., Nashua, N. H.

LONDON LETTER

THERE is news of considerable developments by British plastics firms in regard to the use of plastics for surgical work. Many British war-injured and civilian raid casualties, for instance—after losing hands, ears, noses or limbs—have been able to return to ordinary life, their natural appearance restored without any multiple operations, entirely because of recent discoveries over here in the use of plastic resins. It is stated that the tests of facial features and hands made from plastic resin have convinced experts that the material may lead to radical changes in surgery.

A leading development has been carried out by Portland Plastics, Ltd., a London firm, who have evolved a resin known as Portex. The inventor, who wishes to remain anonymous, is an Englishman, a former student of Guy's Hospital, London, who has spent the past 5 years working on his discovery. The synthetic resin can be made to produce either a very hard "ivory" or "bone," a soft, resilient rubber-like substance or a liquid. The material can be used to build noses, cheeks, ears (the latter made in resilient compound), and even to replace skin tissues. Flexible to any degree, the material can be made and fitted in a few days. Artificial joints can be made in cases where rheumatism or some other disease has destroyed bone and caused a joint fixation. Internal splints for bone fractures which are transparent to X-rays and eliminate unnecessary wastage of time—also flexible, tough tendons for enabling the restoration of function where burns and other injuries have destroyed them—can be made. Natural looking artificial teeth and denture fillings which are unbreakable and do not "clack" have already been made from the resin, and it is possible to produce contact lenses from it which will not become roughened or corroded. Fourteen different skin tint colors can be given.

Portex is also likely to find extensive use in liquid form. On application to the skin, the liquid dries immediately and forms a sterile elastic coating. It is thus invaluable when sprayed over the dressing of a severe burn as a sterile air-excluder. Further, owing to the shortage of rubber gloves (particularly acute in Britain), it is hoped to solve the problem by covering surgeons' hands with Portex liquid before they operate. Simply by immersing his hands in the liquid, the surgeon would be equipped with elastic and sterile operating gloves.

Another development in medical fields over here has been the wider use of transparent plastics in production of surgical demonstration models. Celluloid has been experimented with, not only in this respect, but also in regard to actual surgical operations. There is now a procedure, in certain facial operations, for fitting celluloid parts into a facial contour and then attaching them under the surface skin to underlying tissues. In time, skin grafted from another part of the body grows over the celluloid.

I think I announced in my last letter that every endeavor is now being made by British plastics manufacturers to stimulate Government interest in plastics, with a view to Government subsidies to facilitate home production of vital raw materials. In this respect, increasing support is being given to suggestions for greater utilization of Britain's vast natural coal resources. Recently there was much concern about the gap between coal production and consumption, but this gap—amounting to less than 11,000,000 tons—has now been made up. This is a hopeful augury for peacetime production, when plenty of labor will be available. A big scheme for research into uses of coal by-products has been launched, at a cost of £1,000,000, and plastics firms are supporting this, though it is hoped soon to achieve a separate scheme of research covering plastics alone. A welcome piece of news has come from the Executive Committee of the Scottish Council of Industry. This body is one of the organizers of a big drive to secure new industries for Scotland (a development rendered very likely by the new hydro-electric scheme which is to cover a large part of Scotland). The Council announces that it is giving special consideration to the position of the plastic and chemical industries, whose development would be relatively simple in conjunction with the big hydro-electric scheme.

Continued progress is being made in the setting up of various new plastic firms, many of them subsidiaries of big combines such as British Celanese and Imperial Chemical Industries. More and more appreciation is being shown of the immense postwar domestic markets that await plastics, if properly planned for. For instance, speaking at the annual meeting of Lacrinoid Products, Ltd., the chairman, Mr. T. L. Horabin, M.P., pointed out that perhaps plastics' "greatest potential postwar development is in products which are at present in small demand, particularly household equipment, such as door furniture, cabinet handles, sanitary accessories. For some years after the war, vast housing schemes will have prior claim upon the productive capacity of Britain. We must play our part in the rehousing of the people by preparing our plans now for the production of those articles which we are specially fitted to contribute to better homes."

During the war, Mr. Horabin pointed out, the use of plastics had been developed tremendously, and plastics had invaded industries hitherto the monpoly of other raw materials. But plastics manufacturers must not forget that the production of many of these older raw materials had also been considerably developed during the war, and in some instances, a substantial surplus of productive capacity would be available when the war was over.

Meanwhile there is continued news of developments of plastics "substitute" wartime products. The British Celanese Co. is reported to have developed a transparent type of plastics for use as a window screen in aircraft, screening out ultraviolet rays and protecting crews from sunburn, etc. Plastic caps are being used more and more for bottles—i.e., hair creams, medicines, foods, beer. The British Admiralty has a number of plastics substitutes in hand, including plastics bodies for various essential components of lifeboats (plastics offering greatly reduced weight). Like the Americans, we are using plastics transparent "glass" for aircraft gun turrets, etc., while another measure which we are taking from America is a switch-over to use of nylon in place of animal bristles for toothbrushes, etc.

From Bakelite, Ltd., there is a report of a new process which uses synthetic resinoids to reduce the porosity of metal castings. This process, developed by Bakelite and a London firm, Commercial Structures, Ltd., enables more efficient usage of porous castings which would otherwise be wasted. According to a Bakelite official description, the process consists of treating castings with a patent Bakelite sealing solution under moderate pressure, so that all pores in the castings are sealed with the solution. These are then subjected to a controlled heat treatment in an oven, and after cooling are tested under specified pressure. The synthetic resinoid within the pores of the metal is cured by the heat treatment, and becomes resistant to steam, water and fire. The process can be applied to non-ferrous as well as ferrous metals, and to light alloys.

In conclusion, I would like just to touch on the labor side of plastics production, particularly in regard to women. For women have invaded the field of plastics production to an immense degree. From talks I have had with various works managers, I would hazard that an average of 80 to 90 percent of the staffs of most British plastics firms are now made up of women. Most of them come to the firms without any knowledge of factory work and without much appreciation of the skill and care which must be exercized in plastic processes. Yet the general admission is that women, as a whole, have become adept at their work in a very short space of time. On the average, they are naturally quicker with their fingers than men. There seems every possibility that many of them will be retained after the war, when increased business should enable an absorption of all competent male labor now in the Services. (*Mailed by Denys Val Baker.*)



You can't chart progress in the molded plastics business with a calendar—it takes a stop watch. It takes one fellow to say, "Here she comes!" and another to say, "There she goes!"

The speed of change in the production of molded plastics is breathless. Methods and practices are improved so fast that the Imagination and Initiative of today are simply old stuff tomorrow. And MATERIALS?—they keep coming along, new and better, seemingly without end.

All this whirlwind progress poses some problems for the user of molded plastics. His best answer is to seek out a molder who is actually a part of the field's advances.

That is a role we are striving to fill, challenging as it is. So far, the records indicate that we have been more than ordinarily "adequate". Customers tell us that we "always come through". And certainly we are among the most active buyers of new and improved equipment in the field—when equipment can be bought.

After all, the thing we have to offer you, as a user of molded plastics, is a fast-paced "Know-How" which operates through a fine organization, properly equipped and up to the minute.

As war demands taper off we'll have capacity for peacetime products, and we're eager to start talking about them now. If you, too, are thinking along those lines, let us work with you.

THE GENERAL INDUSTRIES COMPANY

MOLDED PLASTICS

Molded Plastics Division • Elyria, Ohio

Chicago: Phone Central 8431
Detroit: Phone Madison 2146
Milwaukee: Phone Daly 4057
Philadelphia: Phone Camden 2215

Transparent enclosures

(Continued from page 93) flexibility is that sheet thicknesses vary + or − 10 per cent. Other minimum tolerances which may be held in practice are listed in Table III.

TABLE III.—MINIMUM TOLERANCES

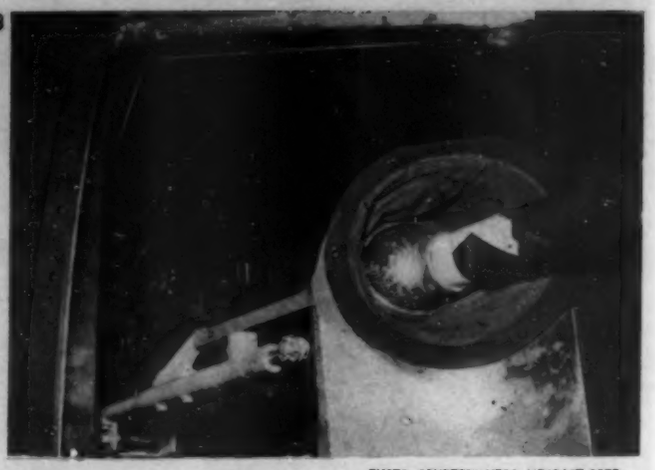
Operation	*Tolerance for sizes less than 12 in.*	*Tolerance for sizes greater than 12 in.*
Machinery flats and contours	±0.015 in.	±0.030 in.
Machinery contours	±0.125 in.	±0.125 in.
Sawing	±0.030 in.	±0.060 in.

Installation—In most enclosure installations it is found that misfitting and rework can be reduced greatly by basing the installation on one master photographic template. Tools and jigs for drilling the windows, jigging for the frames, and check fixtures all may stem from this original template. Actual drilling of the locating points and insertion of the windows should be done between 60° and 80° F. in order to assure breather space at both higher and lower temperatures.

When bolting is employed, the number of bolts used to hold the enclosure should be as large as practicable. This distributes the load more evenly and requires less stress at each point in order to hold securely. In general, clamping action obtained without the use of bolts through plastic is preferred.

The accompanying illustrations of typical mounting applications are shown with a view to aiding the designer in solving his problem. The pro's and con's of each sketch point out the pitfalls into which a poor design can fall and, contrarily, the good features which provide for easy attachment on the assembly line and out on the battle line.

23



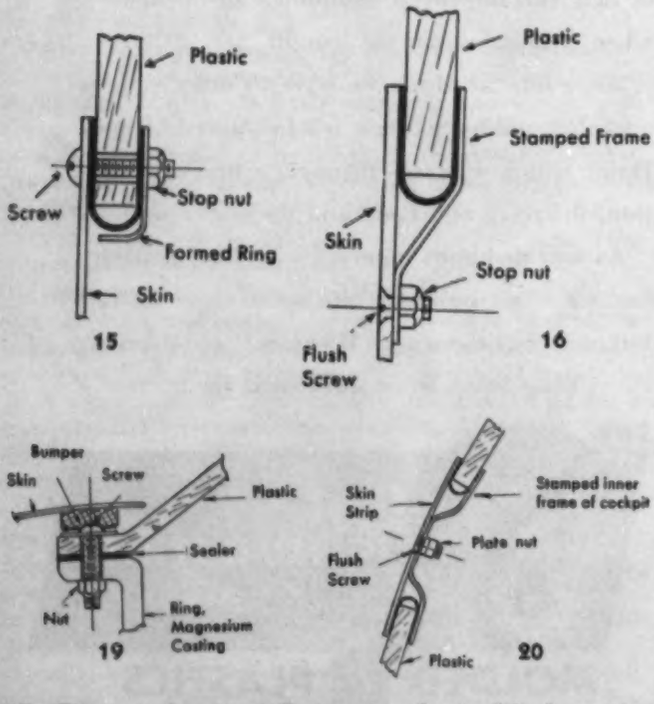
PHOTO, COURTESY VEGA AIRCRAFT CORP.

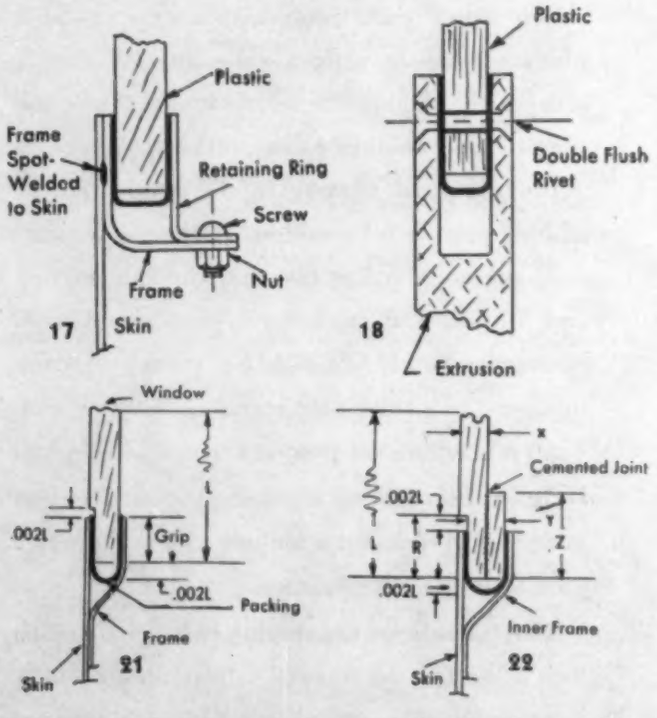
23—*A view of a right-hand nose gun installation*

TABLE IV.—OPERATIONAL TOLERANCES

Operation	*Material*	*Tolerance*
Deep drawing complex curves	Methyl-methacrylate Cellulose acetate	Allow a minimum tolerance of 0.150 in.
Routing and internal corners	Methyl-methacrylate Allyl resin Cellulose plastics	0.125 R 0.125 R 0.06 R
Cold bending	Cellulose acetate (only)	70 times gage thickness

DRAWINGS, COURTESY VEGA AIRCRAFT CORP.





15—*This window installation is of simplified construction, but it is a poor practice to drill the plastic.* **16**—*There are no holes in the plastic of this window. Stamped frames make fast production possible.* **17**—*In this window it is difficult to match retaining ring with frame. Spot-welding eliminates interference with rivets.* **18**—*Window and frame are installed as a unit. Special extrusion is needed; double flush rivets are to be avoided.* **19**—*Redesign of astrodome eliminates drilling of plastic. Dome hinges inward to allow mounting of plastic to casting.* **20**—*The plastic is mounted from outside of cockpit window and held in place with strips.* **21**—*This drawing shows window clearance requirements.* **22**—*In this drawing, window clearance requirements:* $Y \geq X$; $Z = 2X$; $Z = R + .25$



Plastic Packaging

LIES IN OUR SPECIAL FIELD

Experience in Packaging
Research in Packaging
Versatility in Packaging
Practicability in Packaging



Packaging has been our business for over half a century. This experience gives us keen understanding of packaging problems—production, shipping, merchandising.

An important part of our service is technical advice in selecting the material best fitted for the job.

Today, our new developments in plastics go into the war effort . . . tomorrow they will be yours.

OWENS-ILLINOIS
Plastics Division

PLASTIC PACKAGING • CUSTOM PLASTIC MOLDING

Plywood tubing

(*Continued from page 82*) antenna mast (Fig. 1) which has been developed for the Army. Ninety feet in length, it nests for shipping in 3 bundles. One bundle measures $7^1/_2$ in. in diameter by 12 ft., a second package $4^1/_2$ in. by 12 ft. and a third small bundle about 12 in. by 12 in. by 3 ft. One man can erect this mast in an hour's time or 2 men, working under favorable conditions, can complete the job in half an hour. This timing compares with the 3 hours formerly required by 5 men to assemble and erect a metal mast. No winch is needed with the plywood mast—only a pulley. Complete with fittings the plywood tubing mast weighs but 200 lb. displacing a similar 500 lb. metal pole.

Ski pole shafts formerly were made of split bamboo which came from a region in China now held by the Japs. After being tested by the Quartermaster Corps, the plywood tubing was found to be the only satisfactory alternate strong enough to meet weather conditions encountered by ski troops. Also, 100,000 ski pole rings made of this tubing were ordered by the Quartermaster Corps.

Another interesting application of this resin-bonded plywood tubing is shown in Fig. 6. In this tripod designed as a support for special Army equipment, rigidity is of utmost importance with light weight running a close second.

Considerations of weight triumph over those of strength in the supports for fire extinguisher bottles being made of tubing for use in Curtiss Wright cargo planes. These holders (Fig. 5) employ a split tube about 5 in. in diameter reinforced at the base by an interior plywood ring. The clip on the outside of the support is for the de-icer line. Trouble light covers in deck turrets of Glenn L. Martin bombers (Fig. 3) are 2-piece assemblies. Each cover consists of a cap and base. Soldiers, jealous of every ounce which they must pack on their backs, can look with favor on the telescope carrying case shown in Fig. 4. However, more important than its lightness is the fact that this tubular container releases critical leather for other necessary work and is less expensive.

Tested and approved by the Armed Forces, this tubing can be used in sub-zero weather where metal would be injurious to the touch. Dimensional stability under sea conditions is said to be an important characteristic of these veneers bonded with urea resins. An example of this application is the oar (Fig. 2) being supplied for Navy aircraft. Each of the 3 sections which go to make up this oar are of a slightly different size. Because of this variation in diameter one part slips into another. Spring buttons which are inserted near the top of 2 of the oar sections, fit into holes made in the lower part of the shafts of corresponding sections and serve to hold the oar together. Tent poles designed for both the United States and Canadian Armies are other articles of war for which metal is not particularly suited. Here again hands would freeze to metallic surfaces in freezing weather. Ordinary wood poles cannot be telescoped thus adding to the difficulties of transportation.

Another interesting application of this resin-bonded plywood tubing can be seen in Fig. 3. This practice bomb, designed for Army Ordnance, holds a cartridge and employs a heavy metal nose. With this tubing as a shaft the nose can be unscrewed from the damaged body and reused on a new practice bomb. Figure 5 shows an oil reservoir made of mahogany and poplar tubing. This piece measures 14 in. in length and 6 in. in diameter.

Another advantage claimed for this material by its manufacturer is that the tubing, by a simple treatment, can be threaded on the job with ordinary pipe dies. Also it may be cut with regular woodworking machinery. In this way straight threaded unions are made. Flanged joints with flat plywood or plain wood also have been used. While standard wood glues may be used on the threaded fittings, thermosetting plastic resins are recommended for a waterproof joint.

Inquiries directed to this New England company suggest numerous postwar uses. A large mail order house plans to employ this tubing in the making of ladders. A rubber company currently is interested in the possibility of using the material for export packing. These and many other uses present themselves as suggestions for possible use in civilian products after the war is won.

Credits—Resin: Bakelite, Lauxite, Le Page's. "Plytube" manufactured by Plymold Corp.

High-strength plastics

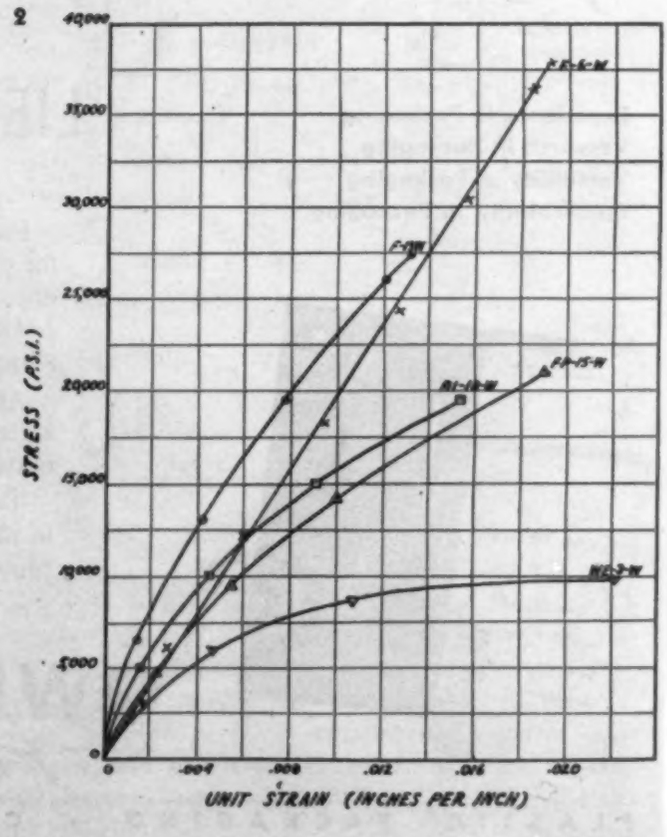
(*Continued from page 109*) the strong plastics with aluminum alloy 24 ST, from the standpoint of sheet buckling. It is apparent that the modulus of elasticity, particularly, of the plastics is not sufficiently high, resulting in inferior buckling resistance in curved sheet form. It is informally understood that the strength values determined by the Naval Aircraft Factory have been exceeded in the latest samples made by manufacturers.

g. Table II shows that the tensile properties at 160° F. are inferior to the properties at room temperature by amounts varying from about zero to about 48 percent.

h. It is understood that low tensile values are obtained in some types of material in the diagonal directions.[3]

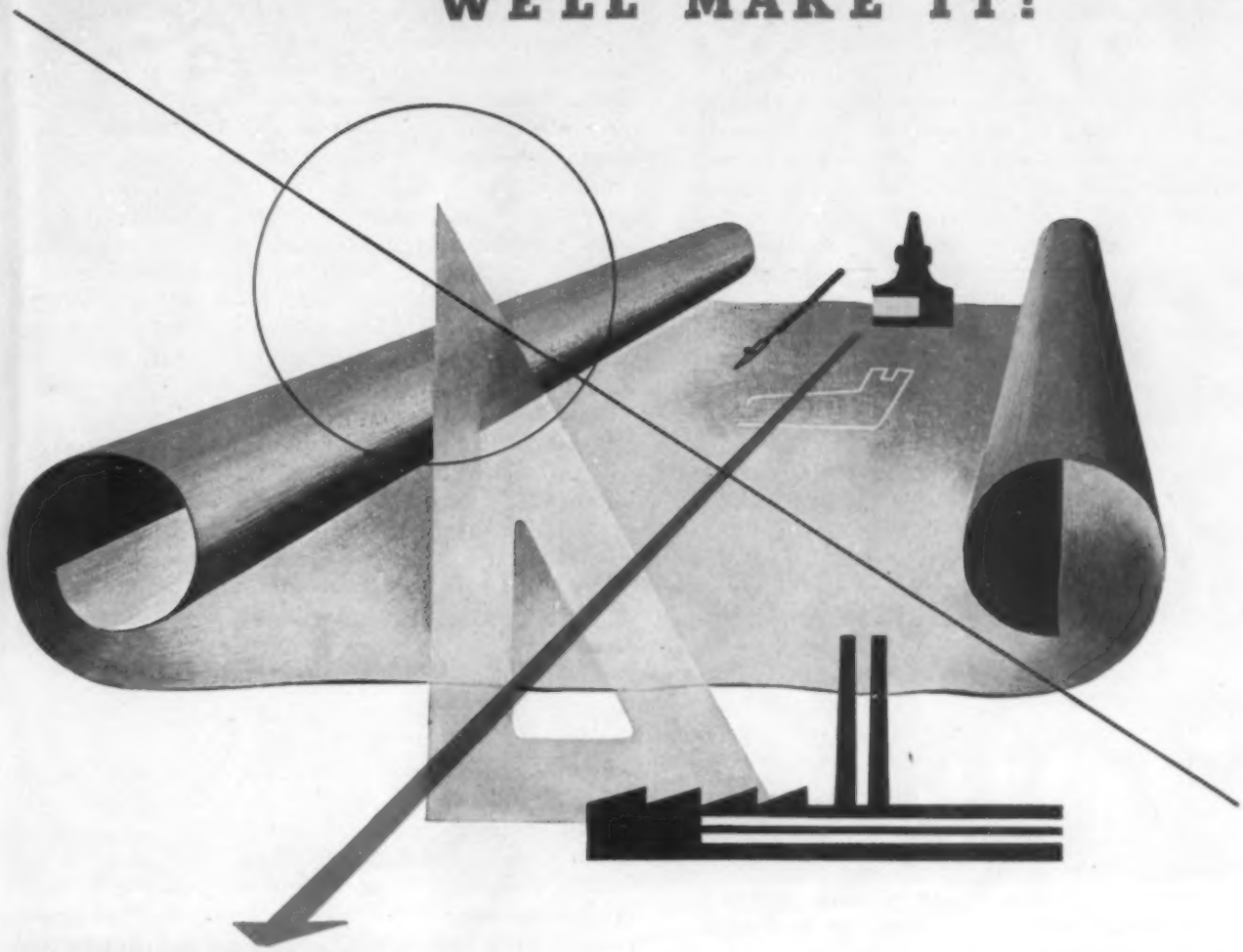
[3] See footnote 2.

2—*Typical stress-strain curves, tension test*



YOU DESIGN IT...

WE'LL MAKE IT!





If you think of Phenol Fibre as a plastic that can be used only for the simpler types of insulation, look at this high-finished radio slider that is drilled, slotted, and beveled into just about as complicated a piece of equipment as you'll find in any electrical device. Taylor ingenuity and Taylor equipment turn out such pieces by the thousands at remarkably low cost. Before you decide "it can't be done," Take it to Taylor.

There are, of course, certain limitations as to what can be made of Vulcanized or Phenol Fibre. *But those limitations are probably much less than you think!* If you are now wrestling with a problem that calls for speedy production of a strong, tough, lightweight, economical part with high dielectric strength, resistance to extreme temperatures and to chemical action, Take it to Taylor.

In the industry's most modern plant, straightline production, from the manufacture or processing of the raw materials to the finished product itself, assures production-economies and quality-control that result in many a modern manufacturing miracle. This Verifibre Process, in which Taylor Fibre is checked and verified at every step in production, produces a product of dependable and uniform quality.

With your blueprints before us, we can tell you in a jiffy how we can help you. Let's talk it over.

TAYLOR FIBRE COMPANY

NORRISTOWN, PENNSYLVANIA

OFFICES IN PRINCIPAL CITIES

PACIFIC COAST HEADQUARTERS: 344 S. SAN PEDRO ST., LOS ANGELES

LAMINATED PLASTICS: VULCANIZED FIBRE • PHENOL FIBRE

SHEETS, RODS, TUBES, AND FABRICATED PARTS

Toughness of materials

(*Continued from page 106*) been made of the apparent tendency of the static bending tests to underrate their toughness. Such materials, however, should be given additional study to further clarify some of their peculiar characteristics.

With the transparent phenolic resin molding material, it is worthy of note that out of a total of 12 specimens tested from a given batch of this material, flexural strengths ranging from 10,000 to 21,000 p.s.i. were obtained. This material appears to be inherently very tough, but in general its excellent strength characteristics cannot consistently be realized because of difficulties in molding and other factors.

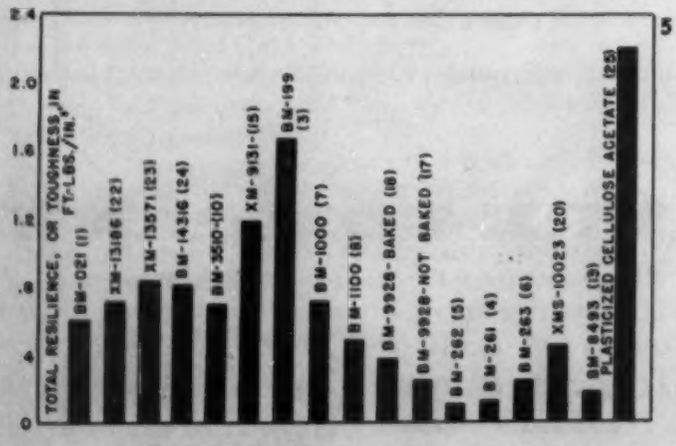
Considerable interest has been shown rather recently in the increase in toughness of the phenolic mineral-filled heater-plug material (Nos. 17 and 18 in the table) when subjected to a certain after-baking treatment. This improvement is said to show up very plainly when heater-plugs of this material are tested in the Underwriters' dropping test. The block diagrams in Fig. 5 show the effect of after-baking on the toughness as determined by the bending tests. The flexural strength is found to increase and the modulus of elasticity to decrease with the after-baking, both of these changes contributing to an increase in the toughness, for the reasons pointed out in preceding paragraphs. The reasons for the observed changes in this type of material when after-baked are not completely understood.

Among the most interesting facts concerning the use of these static bending tests is that mineral-filled phenolic materials are given toughness ratings more nearly in agreement with ordinary experience where these materials are concerned than are indicated by the standard impact test methods.

Conclusions

In general, that mechanical strength characteristic of materials intended to be described by the term "toughness" is not very clearly defined in a way to make possible its determination in quantitative terms, nor does there appear to be any generally accepted single test that is capable of evaluating this property. The standard impact test methods designed to measure directly the shock resistance, resilience, etc., of molded plastics and other structural materials, while serving a very useful purpose as control test methods, cannot be depended upon alone to evaluate the toughness of materials. Some of the difficulties with impact tests, however, appear to result from improper interpretation of the tests rather than from faults of the test methods themselves.

5—Chart showing the "toughness" of various molding materials as determined from energy required to break standard A.S.T.M. flexural bars in static bending tests



For the purposes of this discussion, the problem of determining the toughness of molding materials has been approached from the point of view of the total energy of deformation in static bending, with results that seem to have considerable value. The energy of deformation of a brittle material, when stressed to the point of rupture in a bending test, is proportional to the square of the flexural strength and inversely proportional to the modulus of elasticity. This fact is of fundamental importance. It is an application to a particular case of the general principle that the elastic strain energy stored per unit volume at a point within a material subjected to mechanical stress within the elastic limit is proportional to the square of the stress at that point and inversely proportional to the modulus of elasticity of the material. A thorough comprehension of this principle as applied to *static bending* is basic to any serious attempt to correlate the results of *impact-bending* tests of the Charpy and Izod types with the fundamental mechanical properties of materials as determined under conditions of statically applied loads.

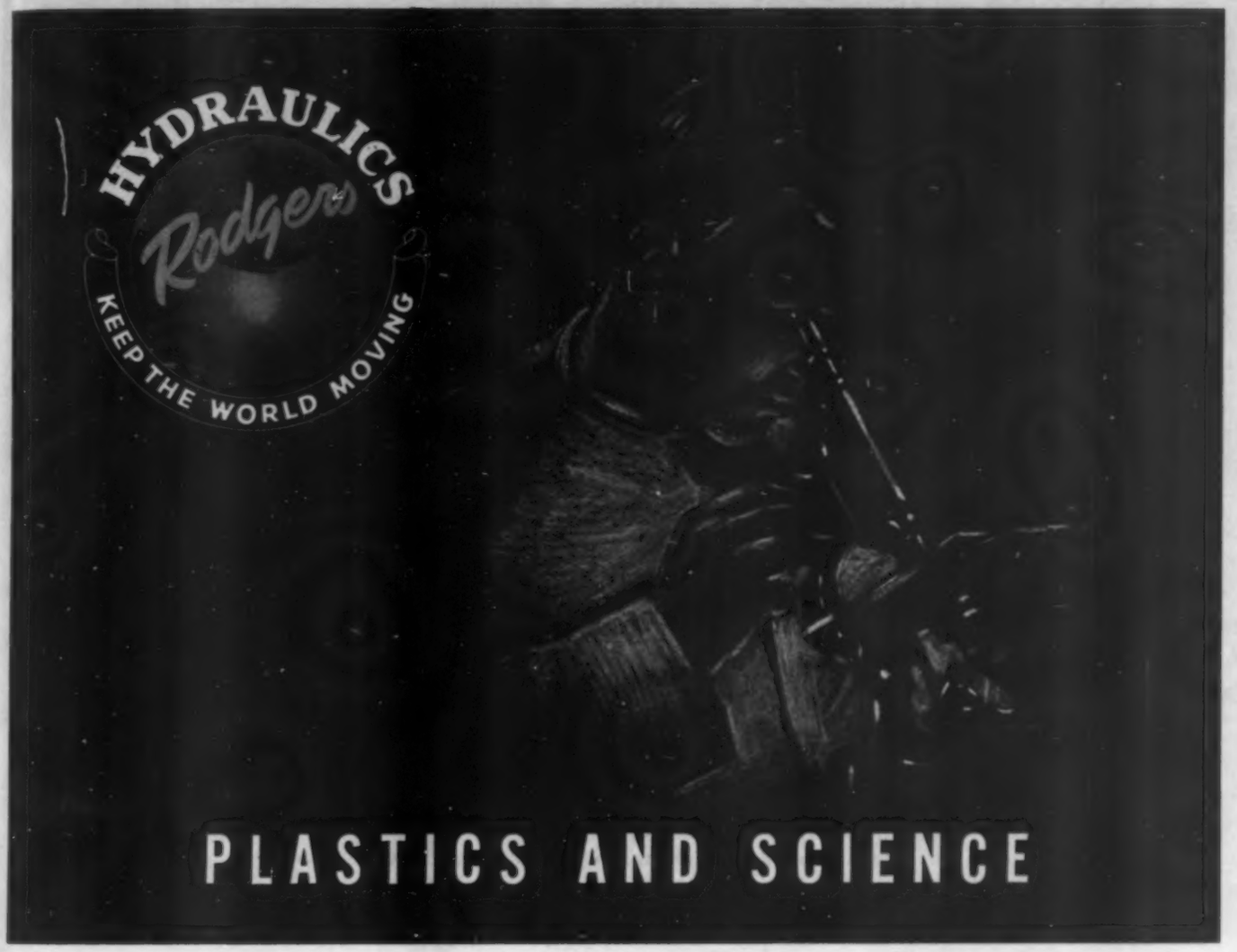
Finally, it is important to emphasize that the toughness of a material, as defined in terms of the energy expended in deforming a standard specimen to the point of rupture under statically applied loads, is in itself a significant property of a material quite apart from any relationship it may have to the general problem of shock resistance, in which the multiplicity of different factors introduced when a material is subjected to dynamic loading may be involved.

Night into day

(*Continued from page 83*) the cord comes out of the unit there is a brass bushing which expands a rubber gasket tightly around the cord so no gas or water can get in. No claim is made that the lamp is vapor-proof, but it is sufficiently water-tight to be used in shipyards for inspecting hulls under water. Pan American Airways use the lamps to inspect inside hulls when Clippers come in from long hauls. Fumes from high octane gasoline build up inside these hulls because of a lack of ventilation, and inspectors have to be careful what sort of lamps they carry in with them since the ships cost three-quarters of a million dollars each.

The lamp comes in 2 lengths—12 and 15 in. equipped with a 6- or 8-watt fluorescent tube—but the outside diameter of each is the same. The practical advantages include: (1) cold light; (2) spherical light that shines in all directions; (3) its slender ribbon shape permits it to be inserted in small spaces where an ordinary extension lamp would not enter; (4) it has a color temperature of white light of 3500°, daylight 6500° Kelvin; (5) it will withstand vibration and reasonably rough treatment; (6) weight of the unit, not including cord and ballast, is only 8 ounces.

Inspecting materials and finished products is of paramount importance in war production. This light-weight portable lamp makes inspection a simple matter regardless of the position of material or products to be inspected. It is essential, for example, to examine the inside of self-sealing bullet-proof gasoline tanks before they are approved. To do this, an inspector crawls inside where ventilation is poor and oxygen is likely to be scarce. A conventional extension lamp with a tungsten bulb big enough to give sufficient light would make it impossible for an inspector to remain in the tank more than 5 minutes at a time. The heat of the lamp would raise the temperature rapidly in this confined space. With the fluorescent portable, the inspector can remain



Manufacturers of:

UNIVERSAL HYDRAULIC PRESSES
TRACK PRESS EQUIPMENT
HYDRAULIC KEEL BENDERS
HYDROSTATIC TEST UNITS
POWER TRACK WRENCHES
HYDRAULIC PLASTIC PRESSES
PORTABLE STRAIGHTENER FOR PIPE AND KELLYS

☆

You've heard it before . .
You'll hear it more . . . .
Buy U.S. War Bonds!

THE APPLICATION of plastics in the industry and civilization of today is one of the outstanding achievements of our age. Many new raw materials may be expected to produce new plastics as research progresses. Plastics are particularly important in a war where raw materials are scarce, and where metals are hard to obtain. Included among the latest plastics products are surgical instruments, X-ray tubes, dental plates, dental instruments, as well as vital equipment for doctors and nurses. Most anything may happen in the realm of plastic chemistry.

Rodgers engineers are developing new mechanical methods and applications which will be an outstanding contribution to plastics moulding, and will be available when peace again comes to our land. ***If it's a Rodgers, it's the best in Hydraulics.*** Rodgers Hydraulic Inc., St. Louis Park, Minneapolis, Minnesota.

Rodgers HYDRAULIC Inc.

until the job is done. Its color temperature of 6500° Kelvin has been determined by lighting engineers as being daylight quality of light, and the lamp gives off no appreciable heat.

Another place where this little portable has improved working conditions and speeded production is in wing assembly in aircraft plants. The inside section of a tapering wing could hardly be called a roomy, comfortable place to work even in bombers or cargo ships. Nevertheless workmen must lie in there on their backs, hours on end, to hold rivets while they are driven home from the outside. Midgets often are employed for this work because it is easier for them to crawl around in such confined quarters than it is for full grown employees. Whoever performs this important work needs light and plenty of it. One weak rivet endangers the ship. The cold light of the fluorescent portable adds nothing to the discomfort in these stuffy quarters. It can be laid on the workman's chest while he works, and its cylindrical shape spreads an even brilliance throughout the entire working space. The outside surface of the lamp never rises above room temperature.

Other vital production spots where the portable fluorescent is extremely popular for bringing daylight to dark corners include instrument installation in the crowded cockpits of fighting ships, electrical installations and equipment within the fuselage, and final inspection after the ship has been "gassed up" for its trial flight, where the hazard of fumes or leaking gasoline exists.

The little lamps are equally useful in the manufacture of tanks, jeeps, trucks and boats of every description where scrupulous care must be taken to see that every working part is in perfect order before it leaves the production line. There are dark corners, many of them, within these vehicles where workmen must be supplied with sufficient light to perform difficult operations with no loss of time. The lamp is used, too, for inspecting barrels having been dubbed the portable "bung-hole lamp" by cooperage firms because its slender shape permits its entry into the barrel through the small hole yet leaves enough space around the cord for visible inspection. Oil companies and brewers also use them for barrel inspection, especially for examining the inside of used barrels where a possible hazard remains from trapped fumes even after the barrels have been washed.

Fluorescent extension lamps give efficient service in the skin-doping departments of glider plants where volatiles make other types of lighting dangerous. The little portable even rides the skies in test flights of Douglas ships, I am told, where it provides light within the cockpit for taking continuous pictures of the instrument panel to record the behavior of the ship. It gets its power direct from the generators on the ship through a 400-cycle inverter.

This fluorescent portable extension lamp is not really new. It has been on the market nearly 2 years, but its rapidly gaining importance to war production and inspection of matériel has focused army and navy attention upon its utilitarian value until it has become recognized as an important piece of maintenance equipment. Slim as a sliver, it can be poked into every crack and cranny of the fighting ship as it comes back from combat for check-up and repairs. A current U. S. Army film, "Dam That Leak," taken at the California plant of Vultee Aircraft, Inc., to show the most modern methods of servicing aircraft in the field, devotes nearly 300 ft. of its 900-ft. length to servicing methods in which this lamp was in continuous use. They call it the "Ribbon Light."

Interesting from the plastics manufacturing point of view is the fact that acetate butyrate is used for all molded parts to bring resilience to the fixture which prevents breakage when it is tossed around. Their combination with neoprene gaskets and a practically unbreakable acrylic tubular shield bring maximum protection to the fluorescent tube within and cushion it against shock or damage from the rough treatment any such device must be expected to experience in wartime work. It will not stand abuse, of course. Hard flow material is used because the heat generated within the lamp itself may reach 105 degrees. The only change-over since the lamp was introduced was from acetate to acetate butyrate for the molded parts.

The success of the lamp in its most critical and useful applications depends upon a water-tight housing for safe and perfect performance although, as I said in the beginning, no claim is made for the lamp being a vapor-proof unit.

Credits—Caps and sockets: Tenite, molded by Modern Plastics Co. Gaskets: Neoprene. Fluorescent tube: Lucite. Lamp designed and distributed by Day-Ray Products, Inc.

Soap in the plastics industry

(Continued from page 88) Large quantities are used by shoe manufacturers, particularly with present military demands, to replace stitching and to speed up fabricating operations. The cements formerly were made largely of rubber usually in an organic solvent. Now, rubber is nonexistent as far as the shoe manufacturer is concerned, and organic solvents are hard to come by. Stepping into this breach are dispersions, in water, of reclaimed rubber and various plastics such as the acrylics, vinyl polymers, cumar resins and certain alkyds. Many of these dispersions are used for impregnating paper to produce imitation leather, belts, notebook covers and the like. One such adhesive, said to be practically odorless,[16] is an aqueous emulsion containing 40 to 45 percent of an adhesive thermoplastic material (such as a mixture of asphalt and cumar resin), 6 to 9 percent rubber and about 1 percent soap. Another such adhesive[17] is prepared by melting a para-indene or similar resin, mixing with a small amount of a non-volatile mineral oil, emulsifying in soap and water and then mixing with thickened latex.

An unusual substance, which might well be considered a plastic, is formed as the result of a fairly recent waterproofing process.[18] Cellulose fabrics are treated with a warm emulsion in soapy water of an organic high molecular weight carbonate or urethane dissolved in benzine. On mangling, drying and heating to 90° C. for one hour, the carbonate or urethane reacts with the cellulose molecules to produce a fabric that is permanently water-repellent.

Soap finds still another type of application in the modern plastics industry—lubrication. Every person who has seen a carpenter use a daub of soap to ease the entrance of a screw into hard wood will not be surprised to learn that soap frequently is used as a lubricating ingredient in cold bituminous molding powders[19] as well as in other molding operations.

Soap and plastics sometimes find themselves bedfellows in strange surroundings. One jewelry cleanser which has the advantage of containing no abrasives, consists of an aqueous solution of soap, methyl cellulose and potassium cyanide.[20] The cyanide and the soap remove surface grime while the

[16] E. O. Groskopf, U. S. Pat. 2,175,797 (Oct. 10, 1939).
[17] M. C. Teague, U. S. Pat. 1,719,948 (July 9, 1929).
[18] W. C. Hunter-Turner, Am. Dyestuff Reptr., *30*, 399 (1941).
[19] *Plastics Catalog*, 1942, p. 145 (Plastics Catalogue Corp., N. Y. C.).
[20] Anders and Berg, Ger. Pat. 700,384 (Cl.22g).

We also do injection Molding"





You may have noticed at the end of each of our advertisements detailing some new development of extruded plastics—which is the main portion of our business—the words "we also do injection molding."

The items illustrated on this page are some products of our injection molding service.

Each is a substitute for natural rubber, made of an elastic plastic material. There is a handle for the steering apparatus of the Universal Arms Carrier (half-track); watertight grommets for jeeps; bumpers for clutch pedal, fender and glove door in an Army truck.

Perhaps this aspect of our plastics manufacturing service can help you meet wartime requirements.

We do extruding, too.



DETROIT MACOID

CORPORATION

12340 Cloverdale Ave. Detroit, Michigan

ORIGINATORS OF DRY PROCESS PLASTIC EXTRUSION

soap and methyl cellulose, probably by virtue of their colloidal nature, help keep the dirt dispersed.

A similar example of cooperative action between soap and a plastic is given in a modern waterproofing process.[21] Paraffin is emulsified in a hot solution of soap and the sodium salt of a polymerized acrylic, methacrylic or maleic acid in water, both acting to help the emulsification. A solution of an aluminum salt is then added, whereupon a mixed dispersion of wax, aluminum soap and aluminum polyacrylate (or the like) is obtained. This dispersion, especially suited to waterproofing fabrics, is said to have the advantage of being stable above 80° C. which means stability at the usual temperature of application.

A recently developed grease[22] that should prove of value in the present mechanized conflict contains lubricating oil, together with 5 to 30 percent common soap and 0.01 to 5 percent of a mixture of polyisobutylene and an oil-soluble linear acrylic polymer of high molecular weight. The soap in this case, as in the many other soda base greases, causes the oil to gel and stiffen and increases its lubricating and wearing powers. The polyisobutylene (as does the soap) causes the grease to take on a stringy, adherent characteristic so that sudden shocks, such as those sustained by auto spring shackles, will not dislodge the grease. The acrylic polymer stabilizes the polyisobutylene against breakdown in its stringiness qualities on ejection through a grease gun.

Still other examples might be presented of the part common soap plays in the modern plastics industry. Enough probably has been said in this limited space to indicate the characteristics and further possibilities of combinations of these 2 versatile materials. We may confidently expect an increased number of applications in the very near future, many of them as vital to the war effort as the ones listed.

[21] E. Gröner, U. S. Pat. 2,285,579 (June 9, 1942).
[22] J. C. Zimmer and A. J. Morway, U. S. Pat. 2,275,123 (March 3, 1942).

Vertical speed indicator

(*Continued from page 100*) completely covered the inside portions of the pellets. This great care was necessary inasmuch as the weight of the pellets had to be held to 5 milligrams with a very small variation permissible. If the paint had been sprayed on directly, the amount picked up by the pellets would have weighed so much that it would have thrown the unit completely out of balance.

No problems were encountered in molding the black cellulose acetate housing which was a straight forward injection job. The lettering, figures and vertical arrows are molded-in and subsequently filled with black paint. The back of the unit is sprayed with white lacquer so that figures and arrows will stand out clearly.

To assemble the unit, the 2 pellets are dropped in their respective tubes, the tops of the tubes permanently sealed with 2 threaded plugs, then the pipe fitting connections are assembled in the 4 connecting holes at the back of the unit. These 4 connecting holes are then cross-connected as shown on the sketch (Fig. 2). When assembled, the unit is air-tight with the exception of the inlet and outlet. One of these connections serves as a vent while the second is permanently connected to a large hermetically sealed can.

The operation of the vertical speed indicator is then as follows: as the aircraft rises, the atmospheric pressure outside the can decreases and, conversely, that inside the can increases. Before the two pressures can equalize, air must pass through the indicator tubes. These tubes are so connected that as air begins to escape past the green pellet, it causes the pellet to rise. Calibrations on the face of the indicator show the rate of climb. Naturally, the faster the climb, the faster the atmospheric pressure will change, and the higher will become the differential between the air inside the can and that without. This, of course, raises the pellet higher. Conversely, as the aircraft comes down, the atmospheric pressure outside the can becomes greater than that inside and the reverse process takes place. In this instance suction is created in the indicator tubes which acts to hold down the green pellet and raises the red pellet, the markings indicating speed of descent.

Inasmuch as the operation of this instrument does not involve pressures but, rather, rate of flow of air, it can be seen that the fit of the pellets inside their tubes is most important. If there were too much space between the pellets and tube wall, the air would escape much faster, and the reading of the pellet's position would be incorrect. Conversely, if the fit were too tight, either the pellet would stick or the air would not escape fast enough to give the proper reading.

The performance of the plastic indicator is said to be almost comparable to that of instruments costing 10 or 15 times more, and its light weight added to its low cost makes it desirable for use in gliders, balloons and training planes.

Credits—Molded by Cruver Mfg. Co. for Army Air Force.

Chemical society meeting

(*Continued from page 112*)

amides do not tend to react readily with formaldehyde to give methylene-bis-amides. The failure of substituted ureas to give polymers can readily be understood if this structure of the urea-formaldehyde condensation product is accepted. A substituent on the basic nitrogen prevents Schiff's base formation and subsequent trimerization and a substituent on the amide nitrogen prevents formation of methylene-bis-amide. Hence, substitution of any kind in urea will prevent the formation of three-dimensional polymeric products in the reaction with formaldehyde.

LINEAR SUPERPOLYESTERS FROM DILINOLEIC ACID. J. C. Cowan, Northern Regional Research Laboratory; and Donald H. Wheeler, General Mills, Inc.

Superpolyesters containing nonconjugated unsaturation have been prepared from dilinoleic acid with ethylene, decamethylene and hydrogenated dilinoleyl glycols. The linear nature and high molecular weight of these polymers were demonstrated by a correlation of molecular weights obtained by end-group determination with viscosity measurements. Correlation was readily obtained with the decamethylene glycol dilinoleic acid polyester to molecular weights as high as 10,000. By use of a glycolysis reaction, a superpolyester having a molecular weight of 24,000 was obtained from ethylene glycol and dilinoleic acid. All superpolyesters were soluble in chloroform and were noncrystalline plastic solids which exhibited elastic properties. On continued exposure to air or on continued heating at temperatures of 290–300° C., conversion to insoluble polymers was effected. These observations indicate that the polyesters are oxygen- and heat-convertible to 3-dimensional polymers. Examination of previous work indicates that the preparation of superpolyesters from aleic, fumaric, citraconic and other unsaturated acids might be possible if suitable precautions were taken in the synthesis.



IN every company there is an important man—maybe it's you—who is looking forward to the day of peace—planning a future that will enable his company to provide employment and better living for our soldiers when they return.

Perhaps that means a new product—certainly a better product—perhaps it's never been made before. It involves consideration of new materials and a comparison with plastics. Such a man needs important guidance on new plastic developments—advice on the new plastics—impartial facts on production methods and costs. Then there's the subject of practical limits and tolerances.

If you are that man we can help you. We've made a habit of solving tough problems for 67 years. We're proud of that record and we are prouder still of the results we've obtained. Let's study our problems together and help you build a better product for tomorrow's competitive world.

MOLDED PLASTICS DIVISION

AUBURN BUTTON WORKS, INC.

Molders of All Types of Plastic Materials by Compression, Transfer Injection and Extrusion Methods

ESTABLISHED 1876 **AUBURN, NEW YORK**

Behind the scenes

(*Continued from page 80*) plication is the forearm for the MP40 Schmeisser submachine gun. This gun also is equipped with plastic pistol grips. Although the plastics laboratory at Picatinny Arsenal has not yet completed investigation of the German matériel, it is quite apparent that the forearm and the pistol grips mentioned above (Fig. 3) were molded from a medium impact phenolic material.

The model 1940 German anti-tank rifle PAB39 (Fig. 4) is equipped with pistol grips apparently produced from Scholler process lignin modified with a small percentage of phenol formaldehyde resin. Figure 2 shows an Italian 9-mm. automatic pistol, model 1934. This pistol is equipped with plastic grips probably molded from a medium impact phenol formaldehyde material.

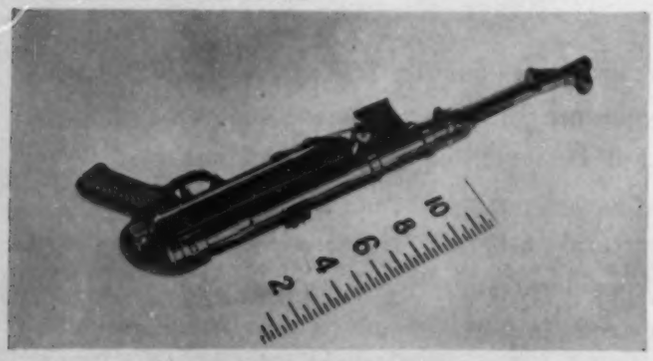
Phenol plastics also are employed by German industry in the manufacture of night lighting device switches, flare pistol grips, anti-personnel shrapnel mines, anti-personnel mine bolt closures and head lamps. Cellulose acetate is used for tail light lenses. The Germans are employing perbunan as a material for taking gun boring impressions and for gaskets in the Teller mine. Synthetic rubber is used in the fabrication of motorcycle seats, knee protectors, foot rests and handle grips.

At the left in Fig. 5 is a drawing of a German trademark found on all ammunition parts. An explanation of the meaning of each component of the trademark accompanies the sketch. In many cases a second trademark appears (shown at right in Fig. 5) which identifies the plant where the component was molded.

3—A German MP40 Schmeisser submachine gun. The forearm and pistol grip are molded of a medium impact phenolic material. 4—This German anti-tank rifle is equipped with pistol grips seemingly molded from Scholler process lignin modified with a little phenol-formaldehyde

PHOTOS, COURTESY U. S. ARMY ORDNANCE

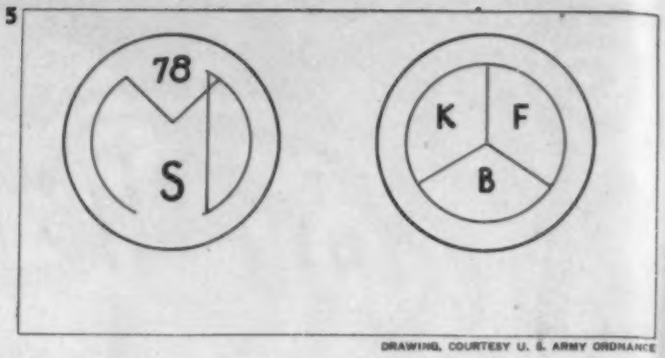
3



4



5



DRAWING, COURTESY U. S. ARMY ORDNANCE

5—Drawing of a German trademark found on ammunition parts. The sketch at left indicates Matèriel Rufungsamt Berlin-Dahlen. Mark at right denotes plant where the component was molded, Karlsruhe Fabrik BildunsMachen

Similar to the Aberdeen trip was a recent tour of Fort Dix arranged by the War Department for members of the Plastics Materials Manufacturers' Assoc. and the Can Manufacturers' Institute. This group, after being welcomed by Major General R. O. Barton, visited all sections of the camp—the hospital, airbase, schools and infiltration course where soldiers crawl several hundred yards under live machine gun fire. To give the visitors a more complete appreciation of Army life, fatigue clothes were issued them upon arrival. After lunching on dehydrated foods the group watched a platoon of the 8th Infantry put on a tank demonstration and other units made a practice assault on fortified positions.

Automotive techniques

(*Continued from page 74*)

Repeater dial for gyro-compass

In the case of the repeater dial for a gyro-compass, the plastic parts are purchased outside. This leaves the metal lithography, etching and assembling to be done in the molder's own plant. The big problem on this job is the extreme accuracy required in marking and calibrating the dials. Five of these repeater dials (Fig. 11) are used on the average ship. Since all dials are tuned in with the master compass, they all must read precisely alike at all times. The aluminum ring backing up the part rides on gears which are closely calibrated. The outer plastic rings are made of laminated paper-based phenolic sheets. This plastic was adopted for its weight advantage and because its translucency permits subdued light to shine through thereby simplifying the reading of dial markings under blackout conditions.

Aircraft instrument board

A typical aircraft instrument board, one of the largest pieces turned out by this plant, is compression molded of black phenolic cotton-flock-filled compound in a single-cavity mold in a hydraulic press of 400 tons capacity (Fig. 10). The curing time is 5 min., and the total molding cycle is $10^1/_2$ minutes. As can be seen in Fig. 10, the central instrument panel has hand-filled white lettering. Because of the unusually high impact strength of the plastic, the board has improved properties and represents a weight-saving

NUMBER 4 IN A SERIES OF EDUCATIONAL ADVERTISEMENTS ON TRANSFER MOLDING



DIMENSIONAL ACCURACY

TRANSFER MOLDING is especially suited to the attainment of accuracy in the molding process without additional machining. For this reason, TRANSFER MOLDING is being used every day for the most critical war jobs in which tolerances must be held close. Exact applications of thermosetting materials, complete with delicate inserts, are achieved through TRANSFER MOLDING that are possible through no other process.

TRANSFER MOLDING has broadened the scope and use of plastics by combining the speed and economy of molding with the precision previously attainable only through long, expensive machining. What this has meant to the war effort can be carried over into postwar production.

TRANSFER MOLDING is the best way to

Handle inserts—metal, glass, ceramic
Mold high-impact materials
Mold unsupported cores
Achieve maximum dimensional accuracy
Reduce trapped gases
Lower mold costs
Lengthen mold life
Increase molding speed
Reduce finishing costs
Improve uniformity of cure regardless of cross-section
Save material by eliminating flash
Get practical solution to difficult molding problems

—on thermosetting plastics.

SHAW INSULATOR CO.

IRVINGTON SHAW NEW JERSEY

as compared with metal. Tensile strength of the material is 6000 to 7000 p.s.i., and impact strength is as follows:

Energy to break FP at R.T.	.23–.30 ft. lb.
Per in. of notch FP at R.T.	.46–.60 ft. lb.
Energy to break FP at −40° F.	.23 ft. lb.
Energy to break FP at 170° F.	.25 ft. lb.

Plastic rivets

Potentially the most interesting of all the new developments, the small tubular rivets (Fig. 12) have so far been produced only on a limited basis. However, they have proved to be entirely satisfactory in such uses as book binding, where they are being used exactly as were their metal counterparts. By the application of heat and pressure, the open end of the rivet is spread and turned back. A plastic counterpart of the familiar metal rivet of which many millions are used daily in aircraft construction, the plastic rivet has been tested in aircraft construction but results are not yet conclusive. It appears that the plastic does not have the strength of metal, but its advantage in dielectrical properties is obvious.

These rivets are injection molded of cellulose acetate in a 60-cavity mold with a total cycle of only 30 seconds. With a battery of machines in operation, a single plant could turn out millions of rivets a day, with almost no manual attentions.

These are but a few of the plastic products that are playing such a vital role in our war effort. But they are representative of the all-out conversion of our automobile industry to war production. They symbolize the improved automotive plastic techniques brought about by the urgencies of war, and they promise much for the day when automobile manufacture can be resumed.

Credits—Material: Collector ring, distributor cap, switch block, repeater dial and firing pin—Bakelite. Vibration damper—Vinylite. Instrument board—Durez. Rivets—Tenite II. Molded by Bay Manufacturing Div. of Electric Auto-Lite Co.

Architectural League exhibit

(Continued from page 136) opened our 1943–1944 program season the plastic world seems suddenly to have burst upon us with an amazing variety of useful forms of almost any reasonable size and shape—remarkable for light weight and construction. An array of small articles confronts us, some entirely utilitarian and some ornamental, some sober in color, others resplendent. At the exhibit we observe an airplane fusilage among the large complex and curved forms. At the other end of the room we look into a show case and see coral embedded in the clearest of transparent materials. Elsewhere we pick up forms some of which are light, strong and rigid, others flexible. We examine cloth and fabrics of textiles, and rope exhibits. We see many things new to us.

"Officially the show has been a success. Opinions expressed by my fellow committee men of the League are all enthusiastic. Personally, I have been much congratulated because I was the one who appealed to you and enlisted your cooperation on behalf of the League, and who solicited the aid of Morris Sanders and his helpers in developing the supplementary program.

"There are a few observations I will make about the machine age and present-day mass production. Plastics play a necessary part on the war production front, but as architects and designers we are not primarily concerned with war. The nature of building leans to the constructive side and not the destructive. The designer is concerned with the quality performance rather than the mass type of production.

"The architect and designer would not welcome plastics as a substitute or imitation of something else but would be inclined to receive it as an honest expression of material, standing on its own feet. If it does a specific job and fits a need better than any material used in the past, plastics will win with the architects and designers. In the case of plastics, light weight and great range of texture, color and flexibility are added assets.

"The plastics show has been very well attended I am informed and the visitors are very attentive. Questions are asked that only a technical expert can answer and we have had to call for help. Some of these visitors are from great corporations. They know plastics and are familiar with chemistry. They seem to be familiar with the new names and terms that in many cases are new to us. But they are interested in design. They evidently would like to know what the designers see in the product. Naturally we are pleased that they are concerned with design for here at the League we live by it whether we are architects, muralists, sculptors, decorators or craftsmen. Design is our trade. We believe that this meeting of industrial minds and designer minds is a fine thing. This is the result for which we planned and hoped. Whether the last word has been said on quality and design as revealed by the exhibition, we cannot state. But from what we see, plastics seem to give the widest scope to the imagination. Its range of capacity in form, texture and color both in opaque translucent and transport materials has plenty of latitude for designing. Even the sober and seemingly only useful materials have plenty of decorative value.

"In summing up we say that the material is very much worth while. The Architectural League is officially very pleased that it has given plastics inclusion in its program. One of our Architectural editors has used the word wonderful and even stated that coupled with our supplementary discussion programs, it is the finest thing we have done. It would be hard to find a more generous praise."

Washington round-up

(Continued from page 128) are made to give leeway in order to operate under practicable minimum working conditions. No producer shall put in process vulcanized fibre of other than natural gray color as such vulcanized fibre is to be finished in sheets of 1 in. or greater thickness except as specifically authorized by WPB. The original order limited the sheets to 1/4 inch.

ACRYLIC ORDER M-260 AMENDED

The principal change in Order M-260, as amended September 14, is the method of reporting. The amendment applies to first grade material only—including first grade cast sheet—but does not include pieces of less than 3 sq. ft. in area produced as a by-product of normal casting or fabricating operations. The reporting method has been changed so that it is now practically the same as the method used for cellulose plastics. Form PD-600 will not be required after October 1, but the user will send a certificate of end use to the material supplier who, in turn, will list all his order on PD-602 and file that form with WPB in Washington. Officials believe the new system will save paper work both in Washington and in the various plants concerned.

The processor will no longer receive notification from Washington that his order has been approved or reduced. In the future, the supplier will notify his customer when an order has been changed or denied. Small order exemptions also have been liberalized. Molding powder has been raised from 50 to 100 lb.; solutions and emulsions have been raised from 25 to 400 lb. (one barrel); monomer has been raised from 10 to 80 lb. (10 gallons).

Coincident with the amendment to M-260, WPB amended M-154 (Thermoplastic Limitations) to include acrylics in order to prevent their being used for less essential items. A change has also been made in the appeals paragraph of M-154 so that when the appeal is based on quality of material, the holder is required to certify that his material is off-grade and not suitable for uses allowed by M-154. It also should be noted that the paragraph relating to bathroom fixtures has been clarified by an explanatory sentence differentiating between private housing, and government or public use such as hotels. *(Please turn to next page)*

A new, modern source of
BY-PRODUCT CHEMICALS



FUEL TAR
CRUDE TAR — CREOSOTE
TAR ACID OILS
PITCH COKE — PITCHES
BENZOL
TOLUOL — XYLOL
SOLVENT NAPHTHA
AMMONIUM SULPHATE
SULPHUR — PHENOLS
NAPHTHALENE

From the newest and most modern eastern by-product coke plant in operation, Pittsburgh Steel Company now produces a line of superior chemicals for many industrial and technical applications.

Improved features and advanced operational methods of this new plant result in chemical products of unsurpassed quality and uniformity.

Inquiries about any of these *Pittsburgh* chemicals and their applications to your problems are welcomed.



Above, Batteries of Coke Ovens; Below, Part of the By-Product Chemical Equipment.

COKE AND CHEMICAL DIVISION

PITTSBURGH STEEL COMPANY 1682 GRANT BUILDING PITTSBURGH, PENNA.

PRICE ROLL BACK FOR THERMOSETTING LAMINATE

A 10 percent reduction in the price of laminated plastic sheets, rods and tubes was announced on September 1, 1943 by OPA. Practically every manufacturer in the industry signed an agreement to roll back their prices the required 10 percent which is approximately to the level of early 1941. The agreement followed an industry conference last August 3 when government officials declared that prices on sheets, rods and tubes had advanced 10 percent since early 1941 and suggested that it would be much simpler to adopt a schedule previously in use than it would be to establish a new rate structure. The lowered maximum prices set forth in the individual agreements for sheets, rods and tubes will be superseded by a permanent regulation to be drafted soon with prices at approximately the same level.

THERMOPLASTICS RESINS UNIT PERSONNEL

With the addition of John Adrian to the staff, the Thermoplastics Resins Unit of WPB now lines up like this: George Sollenberger of Rohm & Haas Co., Chief and Administrator of M-260 (Acrylics) and M-170-a (Polystyrene); E. F. Swenson of E. I. du Pont de Nemours & Co., Inc., Administrator of M-326 (Cellulose Flake), M-326-a (Cellulose Plastics), M-154 (Thermoplastic Limitations), L-20 (Cellophane); C. D. Kerr of Nixon Nitration Works, Assistant Administrator to Mr. Swenson on all orders except L-20; John Adrian of Sylvania Industrial Corp., Assistant to Mr. Swenson on L-20.

SAVAGE LEAVES WPB

James H. Savage, plastics consultant of the Materials Branch, Conservation Division of the War Production Board, resigned, effective October 2. He has set up a private office and will become a plastics consultant in New York City.

S.P.I. news

(*Continued from page 134*)

"Load and Progress Charts" was the subject covered by Herbert Spurway, Boonton Molding Co., at the third of the monthly meetings conducted by the New York Chapter of SPI. The meeting was held at the Waldorf-Astoria, New York City, on September 14.

• • •

A meeting of the SPI Technical Committee was held on August 25 at the Hotel Pennsylvania in New York City with N. J. Rakas as chairman. The proposed classification of plastics materials was the principal subject of the meeting. The materials are to be indexed on the basis of their engineering properties rather than chemical composition. The members of the committee who will undertake this work are: Edward F. Borre, W. C. Goggin, J. A. Mickey, C. N. Sprankle, G. M. Kline, G. M. Kuettel, L. K. Merrill, K. B. Goldblum, J. C. Kazimier, A. E. Byrne, H. K. Nason, W. A. Zinzow, R. M. Berg, Charles Stock, W. M. Phillips.

• • •

The Chicago Chapter of SPI was officially launched at a meeting held on August 21 at the Merchants and Manufacturers Club, Chicago, Ill. Since many of those attending the organization meeting felt that they wished to become better acquainted before voting on full term officers, it was decided to limit the original chapter officers to a 3-month term. Those elected were: chairman, B. C. Maywald; secretary-treasurer, A. J. Bachner, Midland Die and Engraving Co.; membership chairman, James E. Johnston, Chicago Molded Products Corp.; program chairman, Norman Anderson, General Molded Products, Inc.

• • •

A Women's Committee has been appointed to advise concerning sightseeing tours, shopping and entertainment. It is headed by Mrs. E. W. Levien of Ivory Craft Corp.

The Canadian Section of SPI held a program meeting on Sept. 23 at Toronto to review the proposed Canadian program for the fall and winter session and to hear reports on committee activities by the Canadian members of the United States committees. William Cruse, executive vice-president of SPI spoke on current activities of the organization. George Scribner was the principal speaker of the evening.

In the news

(*Continued from page 134*)

★ AMERICAN CHEMICAL SOCIETY'S NEW YORK Section, Inc., and Society of Chemical Industry have issued the following schedule of meetings for the 1943–1944 season: October 8, New York Section; Oct. 22, Society of Chemical Industry, Cohoe Dinner; Nov. 12, jointly, S.C.I. in charge, Chemical Industry Medal; Dec. 10, jointly, N.Y.S. in charge; Jan. 7, jointly, S.C.I. in charge, Perkin Medal; Feb. 11, jointly, N.Y.S. in charge; March 10, jointly, N.Y.S. in charge, Wm. H. Nichols Medal; April 7, jointly, S.C.I. in charge; May 5, New York Section annual meeting; and June 9, New York Section.

★ A THIRD STAR FOR ITS ARMY-NAVY "E" PENNANT has been awarded the Camden plant of RCA Victor Div., Radio Corp. of America, for continued excellence in the production of vital radio, sound and electronic war equipment.

★ AT A RECENT MEETING OF DEPARTMENT STORE and retail trade executives, L. H. Chenoweth of B. F. Goodrich Co., revealed that postwar expansion of koroseal's uses and methods for its distribution were being geared to keep pace with the wartime 6-fold increase in production facilities plus the broadened knowledge of its processing possibilities gained through meeting the needs of the armed forces. In addition to mentioning such military applications as sheathing for wire and cables, waterproofing of clothing for the Armed Forces, and coating on face masks and jungle suits, Mr. Chenoweth predicted such postwar developments as bendable and expandable water pipes, garden hose $^1/_2$ lighter than rubber hose and coated wallpaper from which finger prints and grease marks can be removed with a damp cloth.

★ "FUNCTIONS OF TECHNICAL COMMITTEES IN Engineering Societies" was discussed at the Sept. 10 meeting of the Chicago Section of S.P.E., by Robert Burns of Bell Telephone Laboratories and chairman of Committee D20 on Plastics of A.S.T.M. Pointing out the problems which beset the plastics technician, the speaker gave hard work and unity as the 2 prime requirements of a successful organization. In a frank outline of what must be avoided if plastics engineering is to attain its proper place in professional circles, the speaker condemned politics, personal jealousies and petty bickering between technical groups. After describing the organization of Committee D20 and its efforts to combine speed with orderly democratic processes, Mr. Burns closed with a plea that plastics engineers submerge all selfish interests to insure the long-haul welfare of the plastics industry.

★ THE PLASTIC ENGINEERS ASSOCIATION HELD ITS first monthly dinner discussion of the 1943–44 season on Sept. 20 at the Yale Club, New York City. President Chris Groos introduced the two speakers, Dr. J. W. Shackleton and Dr. G. M. Kuettel, both of E. I. du Pont de Nemours & Co., Inc. In addition to his discussion of "Machining, Polishing and Fabricating of Cast Methylmethacrylate Resins," Dr. Shackleton spoke of several tests showing plastic creep under stress and recovery upon removal of stress. He also touched upon a new development which, if successful, will go a long way toward revolutionizing stratosphere airliner construction. A "safety plastic" made of standard Butacite (the center layer of normal safety glass) and Lucite sheeting laminated into one sandwich, is now under test. If first indications are correct, a record breaking development will be announced in an early issue of MODERN PLASTICS. Dr. Kuettel discussed DuPont's new heat resistant methylmethacrylate molding compound and completed a few experiments indicating the increased resistance of this new material to heat.

Something NEW has been ADDED

A star has been added to the Army-Navy "E" burgee which flies over our plant. This, of course, means that the production records which were established originally to win this award have been kept up, or exceeded, during the past many months. Every Franklin employee is proud to have had a part in the establishment of this record and each and every one of us pledges faithful continuance of production, both in quantity and quality, which will help to win the war. Your invitation for us to participate now in post war planning will receive our enthusiastic attention.



Franklin

FRANKLIN PLASTICS DIVISION
Robinson Industries Inc., -- FRANKLIN, PA.

HOW TO FASTEN

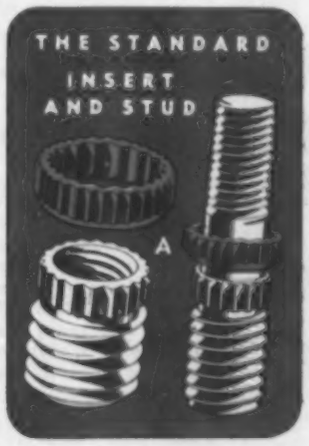
Threaded Inserts and Studs
In all Materials PERMANENTLY



THE LOCKING SYSTEM of Rosán Studs and Inserts has served the problem of fastening permanently in metals, plastics and wood. The serrated collar engages the inner teeth of the Rosán Locking Ring A, as shown in the illustration below, while the outer teeth or splines of the ring broach their way into the surface of a counterbore. Pressure of the surrounding material causes the ring to close in on the collar making a solid and permanent installation. The outer teeth are so finished that they broach the parent material without distortion and without creating any sharp angles which might be possible points of failure.

The torque necessary to remove a frozen nut cannot disturb a Rosán Locked-in Stud since it never backs. The Rosán Locked-in Insert is likewise a permanent installation which will withstand greater loads than the bolt which is screwed into it. Standard threads throughout, easy to install, no special taps or screws required.

There are types of Rosán Locked-in Threaded Inserts and Studs for every industry. Send the coupon below for full information:



★

Manufacturers are invited to submit their fastening problems to our Engineering Department. No obligation.

★

"If the material can be threaded, the Rosán Locking System will lock a threaded insert or stud in it permanently."

BARDWELL & McALISTER, INC.

THE ROSÁN LOCKING SYSTEM

BARDWELL & McALISTER, Inc.,
Dept. 1103 7636 Santa Monica Blvd., Hollywood, Calif.

Please send free literature and full information on the Rosán Locking System to . . .

Name _____ Title _____
Dept. _____ Firm _____
Address _____

SARAN



TUBE
PIPE
FITTINGS
SHEET
ROD

A tough thermoplastic originally made to replace such strategic war materials as aluminum, stainless steel, nickel, copper, brass, tin, and rubber. Now found adaptable to a wide range of uses in product designing, food processing and wherever non-corrosive materials are necessary. Its insulating qualities, flexibility and ease of handling make it extremely valuable in installations requiring the transport of oil, gas, air, water and corrosive chemicals. Complete technical data sheets and price lists on request. Ask for Bulletin P-8.

Pat. No. 2160931



HODGMAN RUBBER CO.
FRAMINGHAM, MASS.

NEW YORK . . . 261 Fifth Avenue
CHICAGO . . . 412 South Wells St.
SAN FRANCISCO . . . 121 Second St.

LYNCHBURG
INDUSTRIAL FINE COTTON
SHEETINGS
for
PLASTIC TRADES
Inquiries Solicited

★

CONSOLIDATED
TEXTILE CO., INC.
86 Worth Street New York City

Owning and Operating Mills at
Lynchburg, Va. Shelby, N. C.

COLTON PREFORMER



THE new improved 5½ Tablet machine is the finest the market has to offer, solid steel frame, improved die fasteners and cam construction, vanadium steel plungers, etc. Write for catalogue.

• ARTHUR COLTON CO.
2604 E. JEFFERSON AVE. . DETROIT 7, MICHIGAN

THERMOPLASTIC MATERIALS

HEADQUARTERS for reclaimed thermoplastics. Acetate, Butyrate, Styrene Celluloid, Acrylic and Vinyl Resins.

LEADING THE FIELD FOR MORE THAN 20 YEARS

WE RE-PROCESS *for* YOU—OR BUY *from* YOU: We reclaim thermoplastics that are off-size or off-standard, including factory residues or scrap.

TURNING WASTE INTO USABLE MATERIAL: We are a source of supply for manufacturers who need clean and graded reprocessed plastics. These are suitable for many applications where VIRGIN materials are not essential or CANNOT BE OBTAINED

Write for details—

GERING PRODUCTS, INC.

NORTH SEVENTH ST. & MONROE AVE., KENILWORTH, N. J.

CHICAGO OFFICE 622 MONROE ST.

FORMALDEHYDE
PARAFORMALDEHYDE
HEXAMETHYLENETETRAMINE
POLYVINYL ALCOHOL (PVA)
POLYVINYL ACETATE

PLASTICS

The strength, appearance and other characteristics of plastics depend on the quality of raw materials. American plastics manufacturers have found that du Pont basic chemicals—building blocks of plastics—are of uniformly high quality. Du Pont is a supplier of Formaldehyde . . . Paraformaldehyde . . . Hexamethylenetetramine . . . Polyvinyl Alcohol (PVA) . . . and Polyvinyl Acetate—emulsion and solution.

DU PONT FORMALDEHYDE . . . full strength U.S.P. solution, water-white in color, low in acid and low in metal content.

DU PONT PARAFORMALDEHYDE . . . powdered or granular.

POLYVINYL ALCOHOL (PVA) . . . high, low and medium viscosity grades, all readily soluble or dispersible in water.

POLYVINYL ACETATE . . . 50% solution in methanol or 55% aqueous emulsion.

All Du Pont plastics chemicals are carefully tested. Shipped in modern containers.

DU PONT

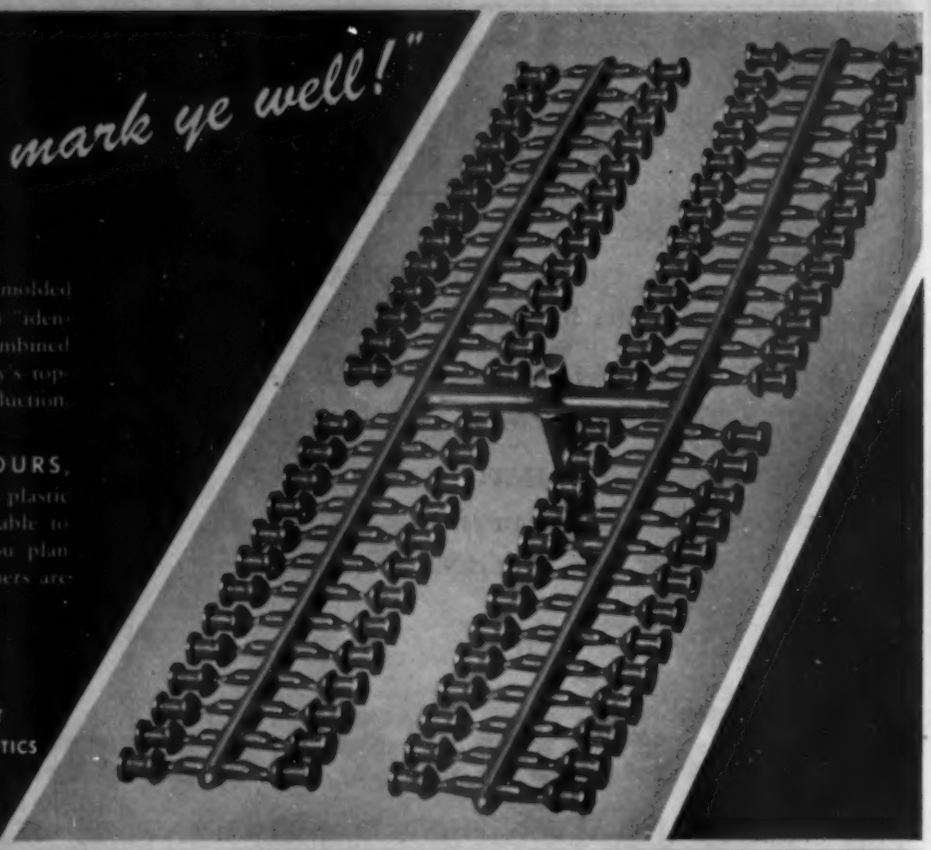
E. I. DU PONT DE NEMOURS & CO. (INC.)
ELECTROCHEMICALS DEPARTMENT
WILMINGTON, DELAWARE

"Mark Ye!
. . . and mark ye well!"

THE IDEAL TRADEMARK on a molded plastic product is more than merely an "identification." Behind each seal is the combined skill and craftsmanship of the industry's top-notch plastic men . . . from design to production.

SOON, WHEN VICTORY IS OURS, Ideal's "Plastic Brains" and tremendous plastic molding facilities will again be available to industry. Meanwhile, we can help you plan for that day. Our engineers and designers are available for consultation.

Ideal — A SYMBOL OF FINEST CRAFTSMANSHIP IN PLASTICS



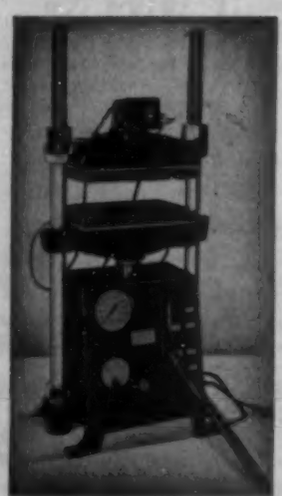
IDEAL PLASTICS CORPORATION
A DIVISION OF IDEAL NOVELTY & TOY CO., INC.
23-10 43rd AVE., LONG ISLAND CITY, N. Y.

THE WABASH PRESS
for
TESTING and RESEARCH

Electrically Heated Platens 540°

Thermostatic Control

Electrical Temperature Indicator



70 sq. in. Platen area

Stroke 8"

Total Force 24,000 Pounds

Descriptive literature on request

LABORATORY SPECIALTIES
INCORPORATED
144 South Wabash Street Wabash, Indiana

TURRET "BLISTERS" trimmed smoothly to size with the CARTER R5A ROUTER



When transparent plastic turret "blisters" for airplanes are pressed to shape by heat process, rough, crimped edges require trimming to fit metal framework. The Carter No. R5A Portable Router has proved readily adaptable for this job, since the tool can be brought to the work, and no complicated holding fixtures are necessary.

The 1 H.P., 18,000 R.P.M. motor operates without vibration, produces smooth, clean cuts that require no further finishing. Write for complete details of the R5A and other popular Carter Tools for plastics fabrication. **R. L. Carter Division,** The Stanley Works, 175 Elm Street, New Britain, Connecticut.

CARTER TIME-SAVING TOOLS

SINCE 1918

PLASTIC MOLDS

HAND
AUTOMATIC
SEMI-AUTOMATIC
and EXTRUSION
to the
LATEST METHODS

Designers and builders of all types of PLASTIC MOLDS.

Serving most of the leading molders of the country!

Our 1500-ton hydraulic Hobbing Press adds many advantages in obtaining lower mold costs.

Estimates on request.



EAGLE
TOOL & MACHINE CO.

37–39 Freeman St. Newark, N. J.
Phone: MARKET 3-1572
-1573

Why not INVESTIGATE?



"What you say about your High Pressure Reducing Valve for plastics plants is TOO GOOD TO BE TRUE," some plastics plant operators have said.

In that event, if you, also, are doubtful, why not investigate? You will find that the

ATLAS Type "E"
High Pressure Reducing Valve

actually does handle pressures up to 6000 lb. per sq. in. without the slightest shock. You will find that it handles water, oil, or air with equal efficiency and ease. You will find that this remarkable valve is being widely used in plastics plants and that we are receiving orders for more from present users almost every day.

These Facts Help Explain:

The ATLAS Type "E" is the "last word" in high pressure reducing valves. Every detail is founded on the latest design and research. Forged Steel body. Internal metal parts entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

For other ATLAS plastics plant products see the partial list in our ad in the January issue of MODERN PLASTICS.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

277 South Street, Newark, N. J.
Representatives in Principal Cities

The second in a series of plastics applications.

This Pistol Grip is a 1st CLASS SEAMAN



MEETING service requirements of durability, weather-resistance and consistent balance, this plastic grip for a distress-signal gun is helping to save lives for the Navy and Merchant Marine. It's only one of many Aico-molded parts which are serving in war . . . saving time in war industry.

Aico's 27 years of molding experience has made possible the rapid and economical production rate of two pistol grips every sixty seconds.



TENITE II PISTOL GRIP

MOLDING MATERIAL

Cellulose acetate butyrate, Tenite II, has good dimensional stability, insuring the necessary consistent weight balance in a part of this type. This Tenite Grip resists corrosion, is weather-resistant, has high impact strength and is not attacked by oil. It is virtually indestructible, has a uniform finish and shows no signs of wear even after long use.

MOLD DESIGN

Two solid, one-piece grips (A) are molded in a double cavity injection mold in one operation. The mold produces the polished (B) and grooved (C) surfaces and a slot (D) for mounting on the pistol. The only finishing required is trimming of gate (E) from the piece.

PRODUCTION

The strength of the finished part depends, to a great extent, on careful production control. Proper heat must be maintained throughout the molding process to assure uniform finish and prevent weld lines which would promote cleavage. The 60-second molding cycle insures an economical and rapid production rate.

Ask to be put on our mailing list for additional copies of this helpful series of file cards on various plastics applications.

AICO

Aico PRECISION MOLDING

AMERICAN INSULATOR CORPORATION, New Freedom, Pa.
Sales Offices: BOSTON · BRIDGEPORT · BUFFALO · CHATTANOOGA
CLEVELAND · DETROIT · NEW YORK · PHILADELPHIA

COTTON FABRICS

FOR REINFORCING

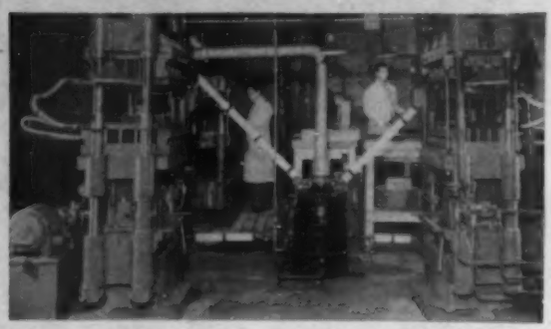
PLASTICS

★

J. H. LANE & CO., Inc.

250 W. 57th St. · New York, N. Y.

A SIMPLE & EFFICIENT
high pressure steam supply . . .



LOW WATER LINE
KANE
GAS-FIRED
STEAM BOILER

Where the same platen temperatures are required for two adjoining plastic molding presses, a KANE Low Water Line Boiler installed between the presses provides an extremely simple and efficient source of high pressure steam. Condensate returns to the boiler by gravity. Constant, even steam pressures are maintained by a specially designed valve in the gas supply line which throttles the gas input in exact proportion to the steam requirements of the platens. For multiple press installations, larger boilers (either gas or oil fired) are available. Also complete condensate return and boiler feed pump systems.

MEAKS KANE OFFELDT
Manufacturers of Automatic Steam Boilers for over a third of a century.
1903-1915 EAST HAGERT STREET, PHILADELPHIA

WE build molds for all plastics

More than 20 years of successful experience as toolmaker to leading custom and proprietary molders qualify us as your mold designer and mold maker on your most exacting jobs of plastics engineering.

Fortney MANUFACTURING COMPANY
MOLDS FOR PLASTICS
247 N. J. R. R. AVE. · NEWARK, N. J.

Protective

Reflective

PEARL ESSENCE

Intensifies Luminescence

SEE
U. S. P. 2,318,089

Non-Priority — Unlimited Quantities

PEARLMAID
PEARL ESSENCE

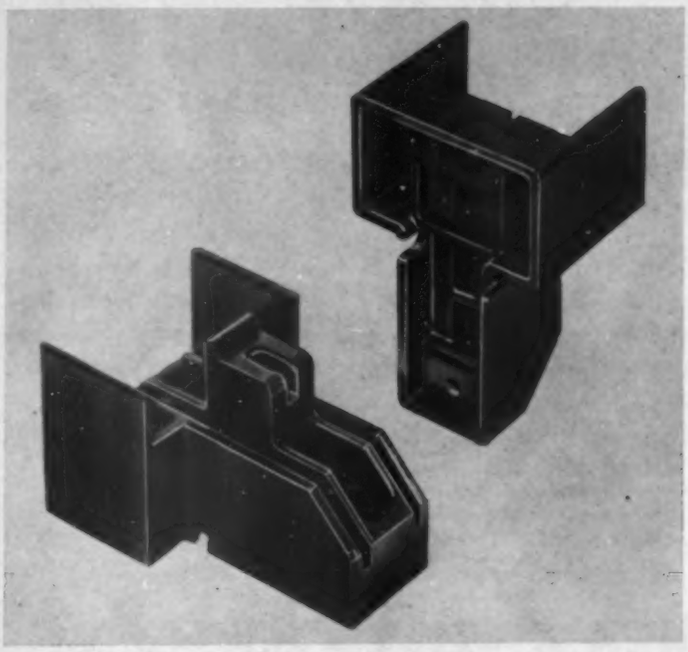
THE
MEARL
CORPORATION
153 Waverly Place New York, N. Y.

No Matter How You Look At It—

a Job of

PLASTIC MOLDING by KUHN & JACOB

looks good from any angle. Long experience with various plastic materials, accurate drafting of design, and equally accurate mold making builds up a production picture that looks good to the customer as well as to ourselves.



Two different views of same object, showing complexity and detail involved. In spite of this, this piece was made in one operation.

Kuhn & Jacob
MOLDING and TOOL CO.
1204 Sotuhard St., Trenton 8, N. J.
New York Office, PEnn 6-0346

7 advantages in PRE-HEATING PLASTICS
with Despatch Forced Draft Ovens



1 BOOSTS PRODUCTION by reducing molding time more than 50%.
2 IMPROVES FLOW of plastic; ideal for large cabinets, etc.
3 CURES FASTER using stiffer materials; gives better finish.
4 INCREASES STRENGTH chemically, electrically, mechanically.
5 AVOIDS STREAKING and color segregation thru even heating.
6 REDUCES STRESS and strains in molded parts; cuts rejects.
7 LOWERS SHRINKAGE.

Save Time and Money!

Ask for complete details about these fast-heating, uniform temperature ovens; ideal for every molder of plastics. Assures better results in *less* time, at *less* cost.

Thermostatically controlled; wide range flexibility. For powders, preforms, molds or sheets. Electric. To 300° F Fully guaranteed.

DESPATCH OVEN COMPANY MINNEAPOLIS
PROMPT DELIVERY

CLAREMONT COTTON FLOCKS

are cleaner
longer
more uniform

MAKE STRONGER AND BETTER LOOKING PLASTICS

Claremont Waste Mfg. Company
CLAREMONT, NEW HAMPSHIRE
—The Country's Leading Manufacturer of Cotton Flocks

STANDARD MOLD BASE FOR INJECTION MOLDING

ready to be shipped to you from stock



BUY WAR BONDS

- **enabling you to get into production 6 to 7 days sooner**
- **eliminating much tedious work and costly errors**

DIME Standard Mold Bases have all preliminary engineering done for you—they reach you ready for cores, cavities, and ejector pins—they are the new, efficient way to better, more economical injection molding.

- Made in all popular sizes.
- Cost less than custom-built mold bases.
- Have interchangeable parts—replacements obtainable from stock.
- Guard against cavities sagging—rigid support given back-up plate by pillars.
- Simplify your designing.
- Long life—more than half the parts can be used repeatedly.

Ask for illustrated catalog which gives full information and engineering layouts with dimensions.

DME

DETROIT MOLD ENGINEERING COMPANY

4837 WOODWARD AVENUE • DETROIT 1, MICHIGAN

NEW YORK OFFICE – 475 Fifth Ave. – Telephone Murray Hill 3-5108

MARKING MEANS MORE THAN YOU THINK



ON THIS WESTINGHOUSE METAL CONTAINER ARE COMPLETE ILLUSTRATED INSTRUCTIONS

permanently applied with a Markem machine and Markem ink. Easy to read, can't wash off, can't be mislaid. This illustrates the possibilities of Markem equipment and Markem service. On any material, any shape, Markem can provide the machine and the ink for quick, clean impression of name, trade mark, part numbers, assembly guide, instructions, etc. In one or several colors. With automatic repeat or changes, and many other features. Put your marking problem up to MARKEM. Ask for Bulletin M10.



PRECISION-BUILT PRODUCTION MACHINES FOR INDUSTRIAL MARKING

MARKEM

Variable Designation

MARKING MACHINES

BOXES, LABELS, TAGS, ENVELOPES. Easy-to-operate Markem Machines print them with trademark and specification imprints, quickly, easily and inexpensively. Print boxes packed or empty. Labels, loose or on the box. Materials may be paper, boxboard, cardboard, fibre, wax paper, or plastic. Also glassine envelopes.

TICKETS, TAGS, LABELS from CONTINUOUS ROLLS, one or two colors; cut-off or perforated; round or square corners; gummed or ungummed stock. Quantity may be automatically controlled. Paper, cloth, fibre, parchment or plastic.

COLLARS, SOCKS, STOCKINGS, SHIRTS, SHOE LININGS and all that myriad of large, hard-to-handle pieces of textiles, leathers and synthetics are marked in necessary detail and trademarked — all with special process Markem inks which assure legibility and durability of impression. Color possibilities unlimited.

GLASS, METAL, WOOD, PLASTICS, PAINTED SURFACES, RUBBER SHEETS — even ABRASIVES! There are Markem machines to trademark, decorate, size-mark, part-mark and do all other stampings on these products in the most approved Markem manner.

SHAPE AND SUBSTANCE PRESENT NO UNSOLVED PROBLEMS! There's a Markem machine to identify or decorate every part or product known to industry. And out of the Markem laboratories come special process inks, rotatable type wheels, special type bars or master printing plates so that Markem is the only source of supply you need for marking machines, devices and supplementary materials.

Tell us today what you want to mark and how you want to mark it. Send for catalog M10

MARKEM MACHINE COMPANY

KEENE, NEW HAMPSHIRE

STANDARD TOOL COMPANY

75 WATER STREET LEOMINSTER, MASS.

1911 — 1943



Thirty-two years experience in Plastics enables us to aid plastic manufacturers in serving their Government more efficiently.



Our experienced engineering department offers the latest and best design in the advancement and development of Plastics—Molds and Equipment.

Lester Injection Molding Machines—New England Representatives. The latest and largest—**4-ounce to 22-ounce.**



Conservation of vital materials calls for efficient **Scrap Grinders**—Ball & Jewell New England Representatives.



Plastic Material Dryer—Parks Standard—U. S. Agents. An efficient Dryer of all materials, scientifically developed for this purpose alone.



Gages—Jigs—Fixtures. Because of our highly skilled personnel and modern equipment, we are serving the Government in the manufacture of these precision tools.



If it is a metal piece to insert by driving, turning or inset, we can make it (design it, if need be) — to exacting specifications and to a high degree of precision uniformity.

MACHINE SCREWS
SHEET METAL SCREWS
MACHINE SCREW NUTS
PLASTIC INSETS
HOLDING PINS
SPECIAL RIVETS

Economy of essential material governs all of our production. Ingenuity saves waste. **Inquiries Solicited**

NEW ENGLAND SCREW CO.
KEENE, NEW HAMPSHIRE
INCORPORATED 1892

Functional Design in Plastics



Through this molded rotor, electrical power flows smoothly from a stationary source to a rotating control unit. Wire fatigue is eliminated and continuous rotation is unimpeded. Developed specifically for aircraft requirements, it is a typical example of how our engineers and molders are prepared to serve industry after the war through functional design in plastics.

The 22 rings in this one-piece slip ring assembly are precisely spaced and transfer molded in a material selected by our research engineers to provide balanced physical and electrical properties. ■ Permanent ring alignment is insured and practically all assembly and service problems are eliminated. ■ The molded finish produced by our one-unit construction is more moisture resistant than a machined surface, with a consequent reduction in power loss.

PM
THE SYMBOL OF ENGINEERING EXPERIENCE AND MOLDING SKILL

■ Projection of molded-in lead wires provides easy attachment of electrical connections. The individual lead wires are numerically identified.

■ Bi-metal rings have copper alloy base finished with silver for better contact and corrosion resistance.

PLASTIC MANUFACTURERS
INCORPORATED
INJECTION AND TRANSFER MOLDING
STAMFORD, CONNECTICUT



Let's Work It Out Together

OURS IS A

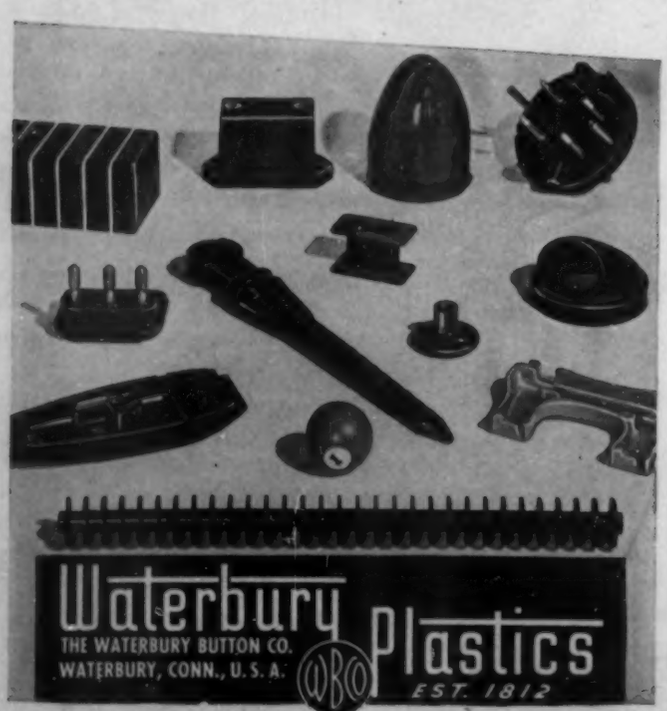
COMPLETE PLASTICS SERVICE

From Idea to Finished Product

"Waterbury Plastics" Service is more than routine molding. It may begin with the idea and develop every subsequent detail.

Are you having trouble fitting a new product into specifications? Would the absence of certain "bugs" in some one of your present products improve it? If so, consult our Designers and Engineers. Equipped with an experience dating from the beginning of plastics in America, they should be able to help you. If you need better molds, we have a department for that—also an assembling service able to handle the most involved assemblies.

Estimate requests receive prompt attention, whether for straight molding or complete service.



Reliable
PLASTIC
CHEMICALS
Chemicals

FORMALDEHYDE

PARAFORMALDEHYDE

•

HEXAMETHYLENETETRAMINE

•

PENTEK

(Pentaerythritol Technical)

PENTACIZERS—a series of New and Interesting Plasticizers
PENTAWAXES—Synthetic Waxes

Write for Data Sheets and Complete List of Products

Please Treat Our Drums Kindly

Don't drop them or use as containers for other chemicals. Move only by hoisting and rolling. Keep clean and sheltered—and *Return* them, also our TANK CARS AND CARBOYS, *Promptly.* *Thank you*

HEYDEN
CHEMICAL CORPORATION

50 UNION SQ., NEW YORK 3

Branch: 180 No. Wacker Dr., Chicago 6

PLASTICS *and* ELECTRONICS

The electronics industry depends in no small part on plastic materials. Only plastics offer the electrical properties combined with the moldability, impact strength and ease of assembly which electronic instruments require.

We have been manufacturing plastics for more than fifty years for all industries, with especial emphasis on electrical goods. During this period we have developed some of our own materials and manufacturing methods. We have also kept pace with the myriad plastic materials now available for manufacture.

This experience is now at the service of the Government and of important contractors in producing essential moldings with high dielectric strength and low-loss factor, for war purposes. After the war our facilities will be available to all peacetime industries.

INSULATION MANUFACTURING CO.
CUSTOM MOLDERS OF PLASTICS FOR INDUSTRY
11 New York Avenue Brooklyn, N.Y.



Metal shortages created a demand for a new filter material. The result was a phenolic impregnated filter media, superior to the original metal element. Another example of a specially developed phenolic material to meet the rigid specifications of today's engineering.

Our Plastics Division produces a complete line of phenolic impregnated fabrics, sheetings and papers for laminating and special uses, all treated to specifications under laboratory control.

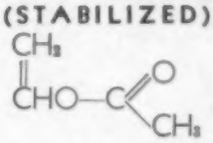
Vinewood 1-8200

DETROIT WAX PAPER CO.
PLASTICS DIVISION
1721 PLEASANT AVE., RIVER ROUGE 18, MICH.

UNPOLYMERIZED

VINYL ACETATE

(STABILIZED)



Purity 99.5% Boiling Range 71.8° to 73° C.

Vinyl Acetate can be polymerized to form resins with exceptional bonding qualities for wood, glass, metal and fiber.

Containers:—
410 lb. drums; 62,500 lb. tank cars

For further information write to

NIACET
CHEMICALS CORPORATION
4740 PINE AVE NIAGARA FALLS, N. Y.

Precision Makes Perfection . . .

PRECISION
PRECISION
PRECISION



. . . and we make precision!

We don't know what methods you are now using to authenticate the measurements of plastic parts or products. But, we'd like to suggest that you use ELECTRIX precision gages. They are the specific controls that can keep your parts within prescribed tolerances — to avoid rejects and time losses.

Including profile, outline, location, and centrality gages, we make 33 different types — accurate to .00005 — but stock none. Every gage is custom-made to the precise specifications indicated for the authenticating job to be done.

GO PRECISION AUTHENTICATORS NO-GO

ELECTRIX Corporation

Peace-time engineers of soft-rubber connectors for electrically-operated equipment

150 MIDDLE ST., PAWTUCKET, R. I.

Keep Heating Element Out Of Your PROCESS PIPES



with H&B Jacketed PIPE and FITTINGS



● In H & B jacketed pipe systems the heating medium does not pass through the flanges, but is transferred by jump-over pipes—thus preventing it from getting into the process pipe. Drain plugs for any mounting position of fittings insure proper circulation and drainage of condensate where steam is used. Write for literature.

HETHERINGTON & BERNER INC.
715 Kentucky Avenue
Indianapolis, Indiana

H&B Hetherington & Berner

PLASTIC MOLDS

Since 1918 leading molders have recognized this firm as the outstanding specialists in the manufacturing of molds for plastic materials, in die-sinking, engraving and hydraulic hobbing. (Capacity 2500 tons.)
Our plant is Keller, Gorton & Blanchard equipped for the most economical and speedy production of superior molds.
Place your problems in the hands of this experienced, well recognized and financially responsible concern.

NDC

NEWARK DIE COMPANY, Inc.

20-22-24 Scott Street, NEWARK, N. J.
TELEPHONE MARKET 2-3772
2-3773

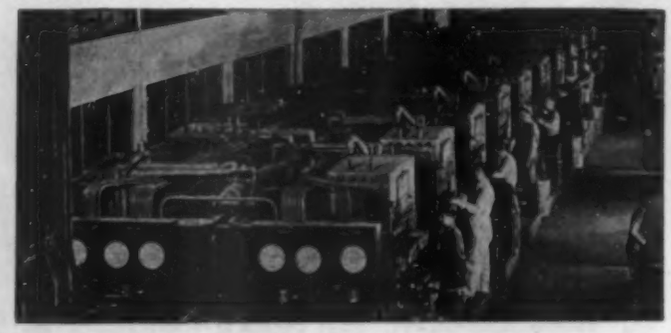
FILLERS

WOOD FLOUR
COTTON FLOCK
and FABRICS
OF SUPERIOR QUALITY
FOR THE
PLASTIC INDUSTRY

LARGEST DOMESTIC SUPPLIERS

BECKER, MOORE & CO., INC.
NORTH TONAWANDA, N. Y.

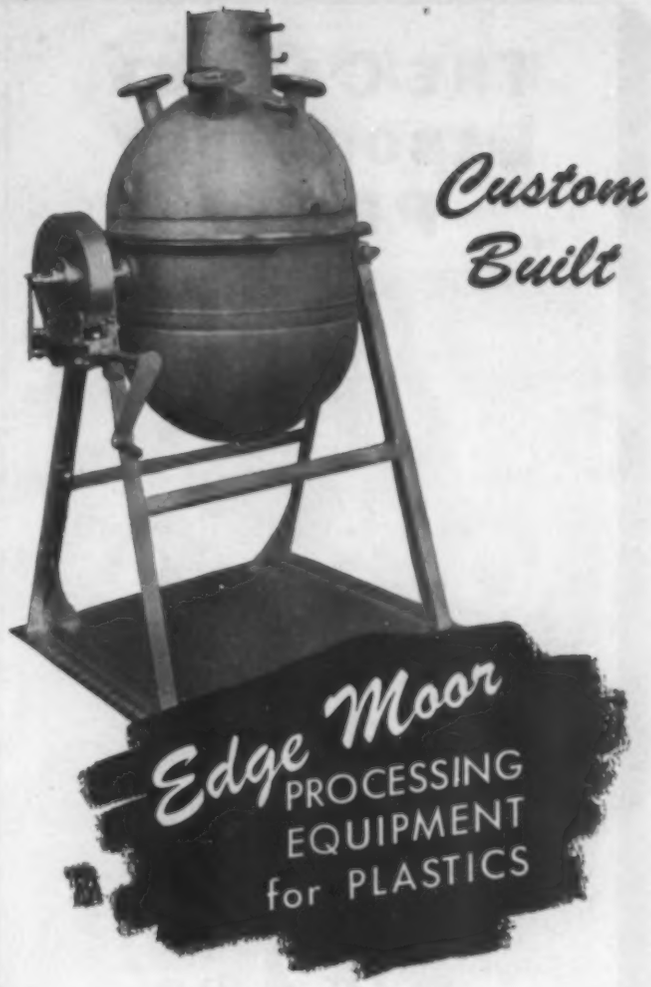




MODERN **FRENCH OIL**
Presses for Molding
Modern Plastics

● For accuracy, speed and economical operation that brings increased profits turn to French Oil Hydraulic Presses, the choice of leading plastic molders. Complete self-contained presses with automatic time control that is instantly adjustable. Dependable, modern French Oil presses in sizes up to 1500 tons are the choice of leading plastic molders. Consult French Oil engineers or write for catalog.

THE FRENCH OIL MILL MACHINERY CO.



Resin Stills—tilting type; welded construction of Stainless Steel or Nickel or clad metals for distilling under pressure or vacuum; jacketed or unjacketed; hemispherical or dished bottoms for any service requiring steam, oil, Dowtherm or electric heating.

Also Mixers, Reflux Condensers, Receiving and Holding Tanks—all built to meet the exacting requirements of the industry.

For 75 years Edge Moor has accumulated knowledge and experience in the design and construction of processing equipment for both the plastics and rubber industry. We believe this diversified experience will be useful in solving your equipment problems. Send blueprints and specifications of your needs for quotations.

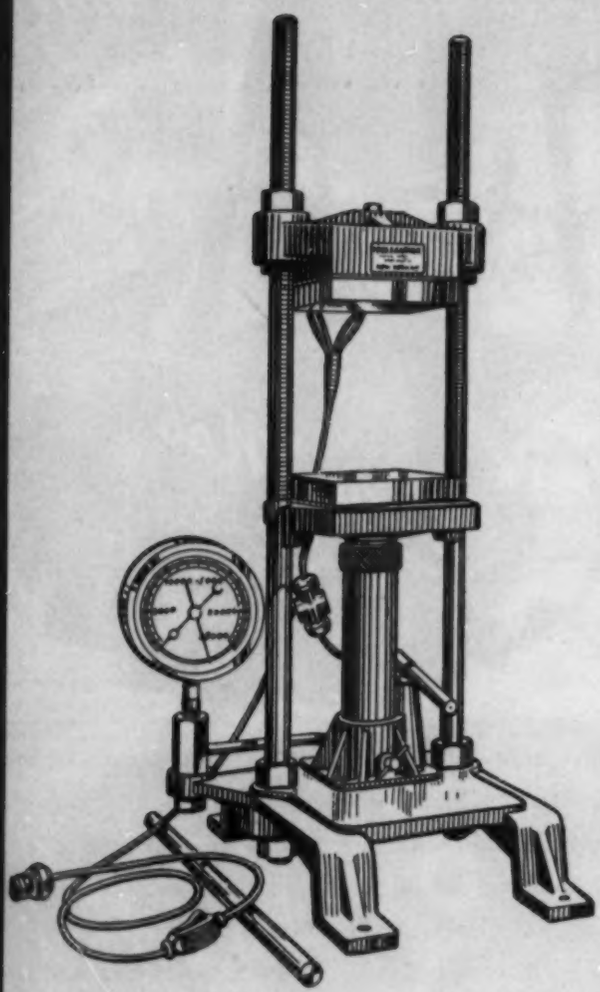
★

FABRICATORS OF PROCESSING EQUIPMENT

EDGE MOOR
IRON WORKS, INC.
EDGE MOOR, DELAWARE

New York: 30 Rockefeller Plaza • Chicago: 1 No. La Salle St.

THE CARVER LABORATORY PRESS



The Characteristic Design of The Carver Laboratory Press is well known. The Press and certain of the accessories are also patented. Now in use throughout the Plastic Industries. Prompt Deliveries on Priorities.

▲

FRED S. CARVER

HYDRAULIC EQUIPMENT

345 HUDSON STREET NEW YORK 14, N. Y.

MPM

This Mold-Mark

MEANS A LOT ON PLASTICS IN THE NORTHWEST

* We have complete tool-room facilities for mold and die-making and are completely equipped for modern plastics molding. Bring us your tough problems.

MINNEAPOLIS PLASTIC COMPANY

2300 East 31st Street Minneapolis, Minnesota

MERCER ROBINSON

EQUIPMENT for the HANDLING of BULKY • CASED • HEAVY

EQUIPMENT for the PROCESSING of CHEMICAL • FOOD • PLASTIC

MATERIALS

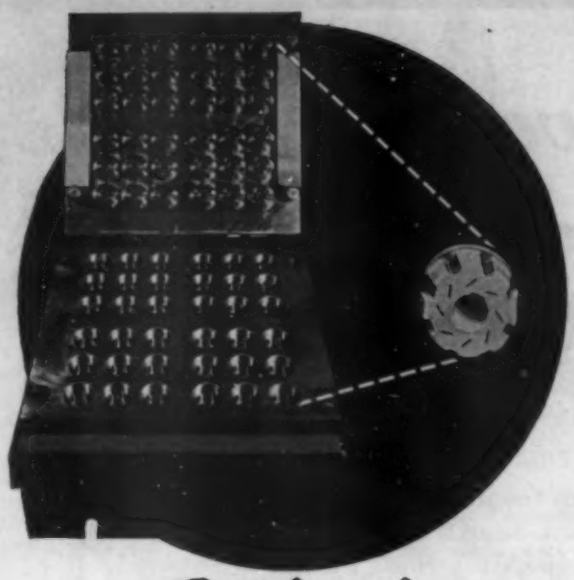
Cranes, Elevators, Lift & Trailer Trucks, Conveyors, Live Skids, Drum Hoists, Tool Wagons, Carts Winches

Crushers, Pulverizers, Grinders, Reducers, Cutters, Blenders, Mixers, Sifters, Attr. and Hammer Mills.

LITERATURE ON REQUEST

MERCER-ROBINSON COMPANY INC

30 CHURCH ST. • NEW YORK 7, N. Y.



Which MOLD STEEL *for this Job?*

● To protect your mold making hours—and to get best molding results—the selection of mold steel for each job should be double-checked.

For example, in making these mold cavities, the mold maker wanted a clean, wear-resisting steel that could be easily hobbed. He found that 100% acid disc inspected *Carpenter Samson No. 1* mold steel would meet his needs and provide a fine-grained tough structure after hardening. The forces were made from *Carpenter Samson No. 2*, the mold steel that provides easy machining.

When you have a problem involving the selection or heat treatment of mold steel take advantage of Carpenter's diversified experience. We can provide you with this useful working "assistant", *Tooling Up for Plastics*—and your nearby Carpenter representative is well qualified to give you personal assistance. Get in touch with him whenever the need arises.



For Insert, Core or Knockout Pins With Greater Strength

—check the advantages of Carpenter Solar Tool Steel and Carpenter Green Label Drill Rod. They are both described in our "Matched Tool Steel Manual", sent free if requested on your business letterhead.

THE CARPENTER STEEL COMPANY

112 W. Bern Street • Reading, Pennsylvania

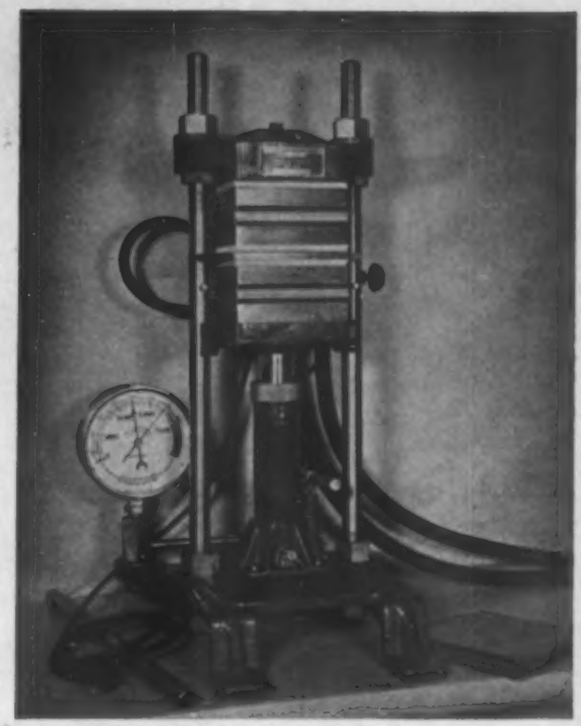
Carpenter

ELECTRIC FURNACE

MOLD STEELS

100% ACID DISC INSPECTED

THE CARVER LAMINATING PRESS





Used in Leading War Plants for Making Tamperproof Identification Cards and Badges

● The Carver Laminating Press has become the standard of quality in leading war plants, Government fields and bases for producing tamperproof plastic laminated identification cards and badges.

Three models of the press make: 150–200 cards (model 122), 300-400 cards (model 124) and 600-800 cards (model 126—shown) per 8-hour day. Each will produce twice as many badges as cards.

Cards and badges produced on the Carver press are laminated and welded between two transparent plastic sheets. Performance is based on rigidly controlled heat and pressure without use of solvents, adhesives or special coatings. The press operates directly from 110 volt A.C. lighting socket. (Supplied for D.C. at slight extra cost.)

Send for Folder and Prices.

We do not supply cards, badges or plastic materials

FRED S. CARVER

HYDRAULIC EQUIPMENT

343 HUDSON STREET NEW YORK 14, N. Y.

Folmer Graflex Corporation—Distributors
Rochester, N. Y.

Everything you want

in this new, rugged, accurate

DURO 18-inch DRILL PRESS

HERE'S a new husky low-cost DURO drill press that can handle efficiently a wide range of drilling and tapping jobs —or be easily adapted for many specialized operations. Feature for feature, it has been skillfully designed for long accurate service under the toughest production conditions. It incorporates new exclusive features that make it one of the outstanding drill press values.

Has Many Outstanding Features. Special design permits quick changing of belts. Has six-spline telescopic, self-aligning spindle that reduces play. Production table has 14" x 18" machined surface. Efficient production foot feed available. Heavy base with 12" x 12" machined surface. Specifications include: ¾" capacity. No. 2 Morse Taper. 4 New Departure Ball Bearings. Speed range 425 to 2030 R.P.M. Spindle travel—5". Drills to center of 18" circle. Maximum distance from base to spindle—49". Maximum distance from table to spindle—19". Overall height—68". Size of overall base —18" x 28½". Diameter of column—3⅛". Weight of Model A3088 (as illustrated) less motor, 350 lbs. Also available in bench model.



Send for New Complete DURO Catalog



The DURO line includes a complete range of low-cost single and multi-spindle Drill Presses, Metal-Cutting Band Saws, Circular Saws, Jointers, Router, Shapers, Grinders, Lathes, Scroll Saws, Flexible Shaft Units, and Portable Electric Drills. Mail coupon today for FREE copy of catalog giving full specifications and prices.

DURO TOOLS

MACHINE TOOL DIVISION

Duro Metal Products Company,
2665 N. Kildare Ave., Chicago, Ill.

Gentlemen: Please send me FREE copy of latest DURO Catalog giving full specifications on new DURO 18-inch Drill Press and other DURO Machine Tools.

Name.....

Address.....

City.....Zone.....State.....

ALSO MAKERS OF DURO HAND TOOLS

Ready... Willing... Able to Deliver

INTERPHONE COMMUNICATION EQUIPMENT



We are tooled up and in production on these and many other inter-communication items, permitting prompt deliveries. Write!

TRAVLER KARENOLA

RADIO AND TELEVISION CORPORATION

1026 W. VAN BUREN ST., CHICAGO 7, ILL.

MANUFACTURERS OF QUALITY RADIO AND COMMUNICATION EQUIPMENT

MOLDING

in all commercial plastics

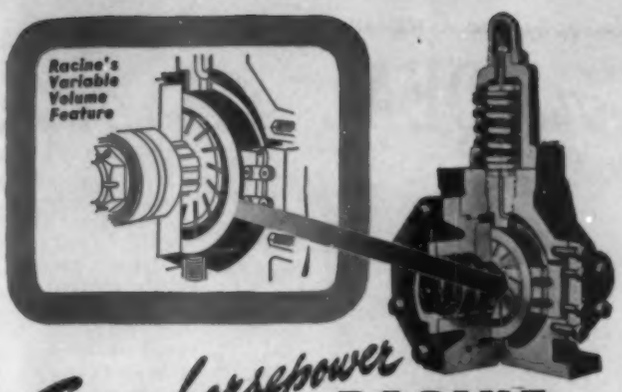
...IS OUR BUSINESS!

There's no application too imaginative, no technical problem too tough for our molding service to handle—and come up with successful moldings. We work in thermoplastics, thermosetting plastics and cold-molded materials, by injection, compression and cold-molding methods. We advise you from more than two decades of successful experience in design and production.

PLASTIC MOLDING

CORPORATION

SANDY HOOK, CONN.



Save horsepower with **RACINE**

oil hydraulic — "variable volume" PUMPS

The "Variable Volume" design of Racine Pumps provides the most efficient use of power—for it pumps only the minimum amount of oil needed to do the job. No waste of power—no relief or by-pass valves required—reduces oil heating. Capacities are 0-12, 20 and 30 G.P.M. at 50 to 1000 lbs. pressure per sq. inch.

RACINE Oil Hydraulic FOUR-WAY VALVES



Racine's "Balanced Piston—Sleeve Type" construction assures complete hydraulic balancing and smooth oil cushioned operation. Complete line of valves for pressure and flow control. Sizes ⅜" to 1½".

Complete data and prices on Pumps and Valves on request. Address Dept. MPL-P.

Racine Hydraulic Metal Cutting Saws

The Production Saws of Modern Industry. Available in a wide range of designs and prices. Capacities 6" x 6" to 20" x 20".

RACINE

RACINE TOOL AND MACHINE COMPANY
Standard for Quality and Precision
Racine, Wisconsin • U. S. A.



For information on our Standard Navy and Maritime Fittings consult Graybar Electric Company.

Northern Industrial Chemical Company

7-11 ELKINS ST., SO. BOSTON 27, MASS.

35 YEARS OF PLASTIC MOLDING EXPERIENCE

MEMBER OF THE SOCIETY of the PLASTICS INDUSTRY

MACK MOLDING EXTRUSIONS





...may have the features you need!

Practically unlimited in length, pattern, design, and color, MACK MOLDING extruded shapes are ideally suited to the designing of unusual treatments and techniques. Heretofore applicable principally for embellishment or protective strips, MACK MOLDING extrusions now serve as components for vital equipment and apparatus.

If you have a problem not yet solved to your complete satisfaction, an inquiry obligates you in no way whatsoever. Mack Molding Company, 100 Main Avenue, New Jersey.

Mack MOLDED EXCELLENCE

SALES OFFICES: NEW YORK CITY, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON & ST. LOUIS



A versitile service...a modern plant with the latest types of machines and presses...all types of moldings by compression or injection methods...an experienced technical staff...a skilled organization geared to wartime service ...designs and ideas which may save valuable production and assembly hours in your plant. Your request to see one of our engineers involves no obligation. Call in UNIVERSAL *on your next molding job.*

UNIVERSAL PLASTICS CORPORATION

New Brunswick New Jersey

NEW YORK: 12 E. 41st Street • PHILA.: Paragon Sales Co., Inc.
CHICAGO: Steel Mills Products Co. • DETROIT: June & Company

☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆☆

The IDEAL Scrap Grinder



Capacity 150-250 lbs. per hour.

A truly new step forward in scrap grinding is the Ball & Jewell *Ideal*. This model embodies a totally new design which saves more than 50% of floor space as against old style machines. It grinds scrap quickly, efficiently, turns it into re-usable powder for molding and extruding.

Has 3-belt Textrope drive, 5 h.p. ball bearing motor, outboard sealed SKF bearings, 7 solid tool steel knives, sturdy cast construction, 3 interchangeable screens, removable bin and baffle hopper.

BALL & JEWELL

20 Franklin Street **Brooklyn, N. Y.**

Since 1895, Manufacturers of Patent Rotary Cutters

or get in touch with nearest representative.

NEW YORK: Alsing Engineering Co., 111 Eighth Ave. DETROIT: J. C. Austerberry & Sons. CHICAGO: Neff, Kohlbusch & Bissell. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ST. LOUIS: Larrimore Sales Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. LOS ANGELES: Moore Machinery Co. LONDON, ENGLAND: Blackfriar's Engineering Co., Ltd. CANADIAN AGENT: Williams & Wilson, Ltd., Toronto & Montreal, Canada

Make your own PHOTO-COPIES

RIGHT IN YOUR OWN OFFICE

ERROR-PROOF • LOW COST



One or a hundred photo-exact copies in jig time, of anything printed, drawn or photographed, when you own A-PE-CO. See how easily and quickly photo-copies are made with this modern, inexpensive, simple method. Let us show you, in your own office, how you can save. No obligation. Drop us a line — *now!*

A-PE-CO *"Photo Exact"*

PHOTO COPIER **$55.00**

Non-Fading Photo-Copies of
• Letters • Documents
• Records • Blueprints
• Pictures • Drawings

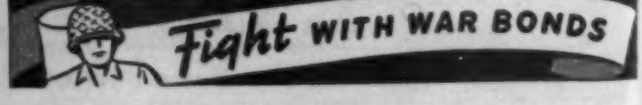
Errorless "same-size" facsimiles of anything up to 18" x 22". Eliminates steno-copying, tracing, proof-reading. Photo-copies direct from letters, blueprints, graphs, tracings, telegrams, receipts, shop orders—anything written, printed, drawn, photographed. Accepted as legal evidence. Endless uses. *Big savings.* Used by industry, Government and engineers.

NO CAMERA — NO FILM — EASY TO USE

Any employee quickly becomes expert. Use A-PE-CO on any desk or table. It's simple; fast. No moving parts. Saves other equipment. Conserves man-hours. Low cost per copy. Low investment. Get *all* the facts. See how you can save. Immediate delivery. Representatives in principal cities and Canada.

AMERICAN PHOTOCOPY EQUIPMENT COMPANY

2849 N. CLARK ST. DEPT. CP-10 CHICAGO 14, ILLINOIS



Turn your

PLASTICS SCRAP

into

WAR BONDS

Consult:



H. MUEHLSTEIN & Co. INC

122 EAST 42nd STREET, NEW YORK, N. Y.

CHICAGO: 327 So. La Salle St. · AKRON: 250 Jewett St. · LOS ANGELES: 318 W. 9th St. · MEMPHIS: 46 W. Virginia Ave. · BOSTON: 31 St. James Ave.

VICTORY
WILL BE OURS

BY PULLING TOGETHER!

We are here to serve our Country, and Customers Old and New, by Providing High Quality Molded Parts.

Our trademark stands for justice, and is backed by an engineering staff of more than thirty years experience.

This background is yours for the asking. Consult us with your problems, small or large, simple or complicated.

Compression and Transfer Molding of Thermosetting Materials Is Our Specialty

PLASTIMOLD, INC.
ATTLEBORO, MASS.

COTTON DUCKS
for
Laminators and Molders

Our Southern mills have made high tensile cotton fabrics for the Plastics industry for fifteen years and specialty industrial cotton textiles for over thirty-five years. Our experienced development and production facilities are available to the Plastics trade, limited only by the requirements of our armed forces.

Curran & Barry
320 BROADWAY NEW YORK CITY

NO HELP WANTED



• Well, not exactly. But our automatic equipment reduces the need for manpower, and brings about uniformity through controlled molding. We produce quality moldings and laminates for four branches of the Army. Our facilities will be available to your industry after the war.

INTERNATIONAL MOLDED PLASTICS

4383 W. 35th Street Cleveland, Ohio

GOING TO SCHOOL AGAIN?



New operators . . . substitute powders . . . new applications upset your old schedules . . . it's like going to school again. Now, more than ever before, it is important to use dependable temperature checking instruments. The CAMBRIDGE Mold Pyrometer is the instrument recommended by powder manufacturers. This accurate, sturdy, quick-acting pyrometer enables the operator to instantly determine the exact surface temperature of each mold cavity.



Combination and Single Purpose Instruments

BUY WAR BONDS

Cambridge Instrument Co., Inc.
3732 Grand Central Terminal, New York City

CAMBRIDGE
Mold—Surface—Needle
PYROMETERS

Bulletin 194—S gives details of these instruments. They help save money and make better plastics.



"STRIATUBE" Plastic Tubing

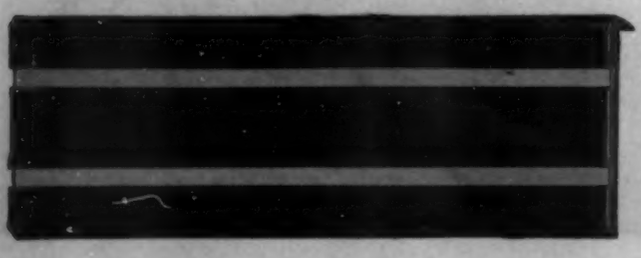
A new and exclusive Carter development, "Striatube" plastic tubing with one or more contrasting color stripes is ideal for electric insulation where easy identification is essential. Color stripes are an integral part of tubing and permanent. Available in either opaque or transparent, flexible or rigid. Highly resistant to acids, alkalies, oil and greases. Wide variety of sizes.

"STRIAMOLD" Plastic Molding

"Striamold" plastic molding with extruded decorative stripes are of special interest to architects, automobile manufacturers and designers generally. Contrasting stripes can be of any color or combination desired.

Write for Bulletin 300

CARTER PRODUCTS CORPORATION
6921 Carnegie Ave. Cleveland 3, Ohio



Stamp NAMES • DESIGNS TRADEMARKS

In Gold, Silver, Colors on Plastic Products

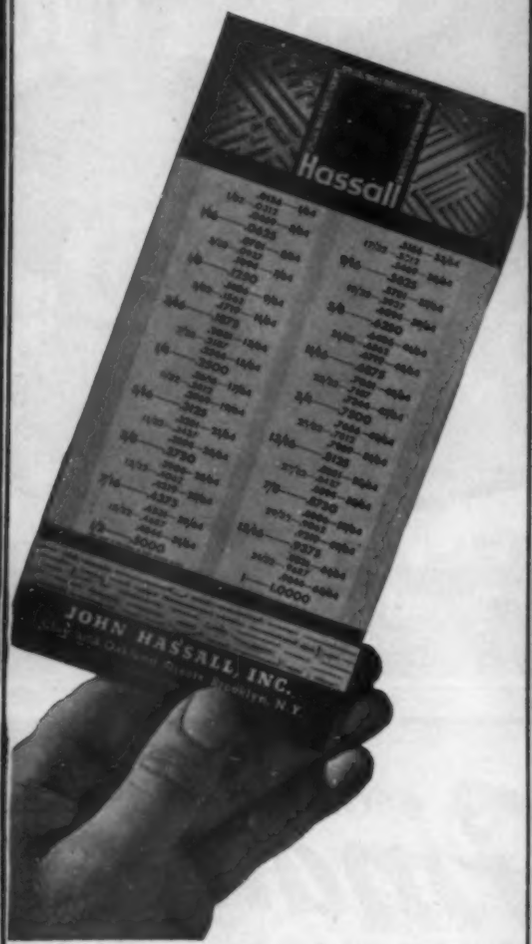
Precision stampings—positive, clean-cut, enduring—can now be done with ordinary girl operators at production speeds up to 1,000 pieces per hour. Write for catalogue, or submit your stamping problems.



Kingsley GOLD STAMPING MACHINE CO.
★ HOLLYWOOD, CALIFORNIA ★

Send for this

FREE CHART



Decimal Equivalents. Accurate to four places. Signaled in three colors for maximum speed in locating decimal equivalent of fraction. Saves time and avoids errors. Yours at no cost or obligation. Just send us your name, title and address.

JOHN HASSALL, INC.

Specialists in Cold-Forging Since 1850

396 Oakland Street · Brooklyn 22, N.Y.

SPECIAL NAILS RIVETS SCREWS
Hassall

P·A·B NEWS

DILLON - BECK, IRVINGTO

ENGINEERS · DESIGNERS · MOLDERS OF PLAS

Keeping Uncle Sam's "Ears" to the Sky Is Dillon-Beck Task



IRVINGTON, N. J.—Typical example of a task which, on the surface, presents no complexities, is production of this sound locator now being turned out by the Dillon-Beck Manufacturing Co. In reality, however, the assembly of these super-sensitive "ears" is an intricate operation demanding careful attention to numerous details.

The aluminum case, for instance, has to be thoroughly sound-proofed, the insulation being cemented in with liquid plastic; the horn has to be finished with a special preparation which protects it against temperature changes and adverse weather conditions; delicate heat treating problems are involved; etc. Altogether, more than sixty component parts are assembled to form the finished product.

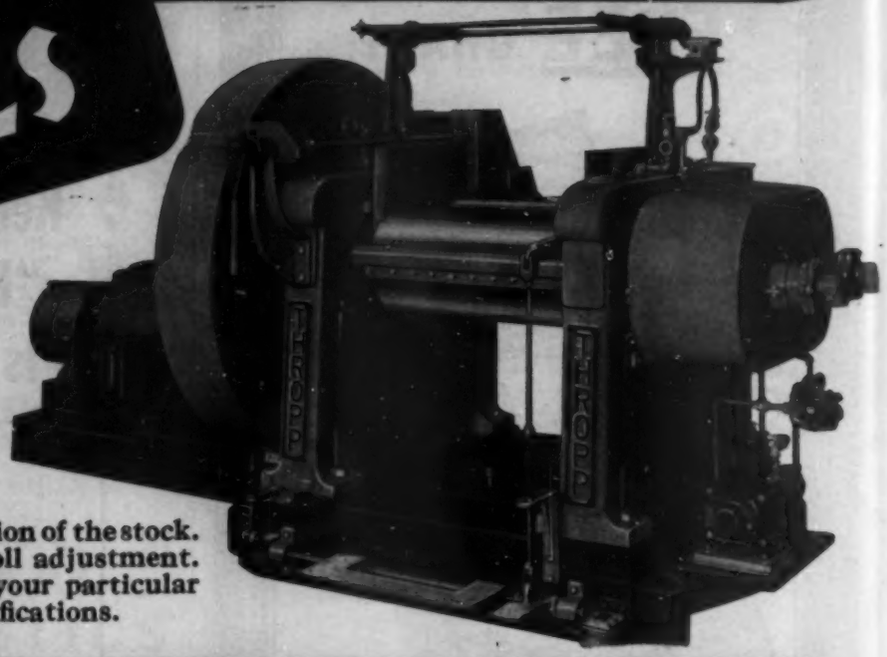
Officials of the Dillon-Beck concern stress the fact that this ability to handle all phases of special assembly requirements is just one more feature of their complete service to users of plastic products.

DILLON-BECK MANUFACTURING COMPANY

IRVINGTON, N. J.

ENGINEERS · DESIGNERS · MOLDERS

New!
HEAVY DUTY
MILLS
for Tough Plastics



Size 14" & 14" x 30"

For mixing, grinding, and sheeting plastics and for blending colors. Mill illustrated is equipped with flood lubrication and oil seal Klosures to prevent oil contamination of the stock. Hand operated, micrometer roll adjustment. Mills can be custom built to your particular requirements. Write for specifications.

WM. R. THROPP & SONS CO., Trenton, New Jersey
PRODUCTION AND LABORATORY MILLS FOR PLASTICS

DIEMOLDING CORPORATION
Canastota, N. Y.

TRADE DM MARK

A complete and thoroughly equipped molding plant with an enviable record of performance for many of the largest users of molded parts, products, premiums and packages

Call upon our engineers and designers for aid or advice in planning your molded parts.

DIEMOLDING CORPORATION
CANASTOTA NEW YORK

Finally!
A DURABLE DECORATING MATERIAL FOR PLASTIC SURFACES...

won't SCRATCH OFF
won't WASH OFF
won't RUB OFF



CREATIVE PRINTMAKERS GROUP 14 W. 17 ST. N.Y.C.
SILK · SCREEN · PRINTERS
TO · THE · COSMETICS · TRADE

Make Plans Now...
for the coming **PLASTIC ERA**



Consult ROGAN

Here at Rogan, seasoned engineers are ready and willing to assist you in determining your post-war *Plastic* requirements.

Whether your peacetime products are to include electronic equipment, electrical appliances, stoves or what have you, the Rogan Organization will gladly provide cost-free advice on all phases of plastic production.

Send Us Your Specifications Today!

ROGAN BROTHERS

Compression Molders and Branders of Plastics

2005 So. Michigan Avenue Chicago, Illinois



PLASTIC MODELS DEVELOP POST-WAR PRODUCTS

● Pieces shown were made for large manufacturer now engaged on post-war development in addition to his war work. They illustrate possibilities of plastics to make full-size or scale models of any item for development purposes. Transparent plastics show all working parts, can be machined to close tolerance.

If final product is to be molded, model can show how it will look and work before molds are made.

We also build working models of machinery in all materials; metal machine parts and full-size machines as well. Our development service works with industries and individuals from ideas or blueprints to finished products.

Write or telephone

STRICKER-BRUNHUBER CO.
Mechanical Developers
19 W. 24th Street S-B New York 10, N. Y.
WAtkins 9-0191-2

HOW TO REPLACE CUTTING TOOLS

that can't be salvaged!



When worn or broken cutting tools can't be reclaimed for further service, replacement should be made with tools that conserve vital materials, time and labor. CLARK CUTTING TOOLS comply with critical requirements, do better work quicker.

They use a minimum of tool steel (in cutting blades only) these can be resharpened repeatedly, replaced economically. Being adjustable, a few sizes do the work of many other tools, slash inventory. They make clean, *finished* cuts, reduce operations.


HOLE CUTTER


FLY CUTTER

EXAMPLE NO. 1

Clark Adjustable 3-Blade Hole Cutters make accurate, smooth holes in flat or curved metal, plastics, wood, transite. 7 sizes cut ⅜" to 5", up to 1" thick. No reaming or deburring. Fewer operations are required.

EXAMPLE NO. 2

Clark Adjustable 2-Blade Fly Cutters. 2 sizes cut holes or discs 2½" to 10", up to 1" thick. Pitched blades cut true, relieve chatter. Other models cut gaskets, rings, discs from live rubber, problem materials.


SURFACE FACER


THREAD TOOL GRINDING FIXTURE

EXAMPLE NO. 3

Clark Adjustable 3-Blade Facing Tools. 4 sizes cover all fractional diameters, 1¼" to 5", do the work of End, Shell and Slab Mills, Inserted Tooth Cutters. Fit all machines. Tools available with all types of blades, including carbide tips.

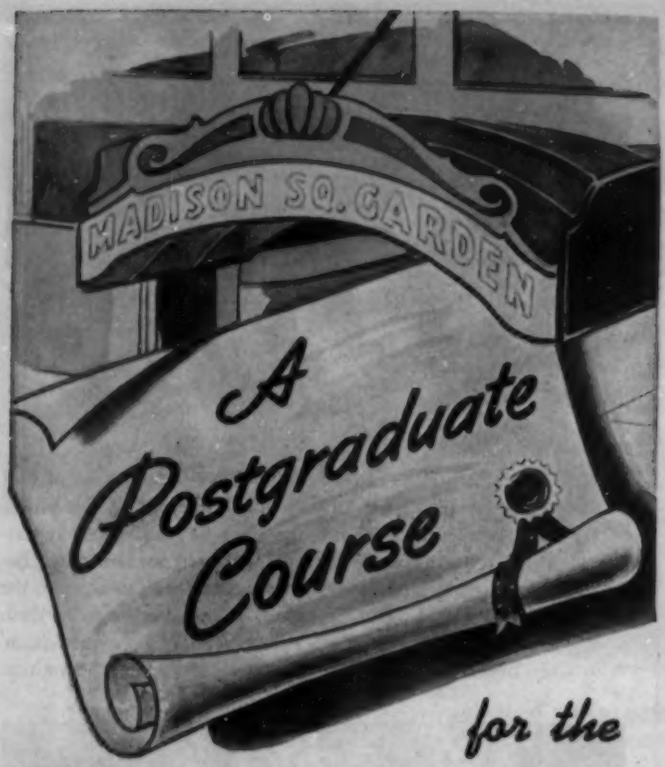
Write for Bulletin MP-10

EXAMPLE NO. 4

A real tool bit conserver! Mechanic's MODEL A and Heavy Duty MODEL B for accuracy, uniformity in grinding *both* National 60° and Acme 29° tool bits. Both models handle bits for use in Armstrong Tool Holders. *SPECIAL MODEL C* for grinding Clark Hole Cutter Blades.

In Canada: DOMINION BEARINGS, LTD., Toronto, Montreal, Winnipeg
Export: THE AMERICAN STEEL EXPORT COMPANY, INC., New York, Los Angeles

Robert H. Clark Company
3424 SUNSET BLVD. • LOS ANGELES 26



for the

PLASTICS INDUSTRY

Under one roof, in Madison Square Garden New York, this year's Exposition of Chemical Industries will present a remarkable educational opportunity. There, during the week of December 6–11, 1943, members of the plastics industry will find the equivalent of a postgraduate course in chemistry and engineering applicable to their own problems.

In common with other fields, the plastics industry is faced with many new problems brought about by war conditions and postwar plans. To an unprecedented extent, chemistry and engineering have broadened their ability to help solve many of these problems—through new products of chemistry and new processes made possible by modern equipment. Visitors at the coming Exposition of Chemical Industries will find a wealth of ideas presented by exhibitors ready and eager to share the benefits of their broad experience. Admission to the Exposition of Chemical Industries is by invitation and registration. You will find here every facility for a thoroughgoing study of the chemical and engineering developments of prime interest to you. By all means come and bring your associates.

19th EXPOSITION OF CHEMICAL INDUSTRIES

MADISON SQUARE GARDEN • NEW YORK

DEC. 6-11, 1943

Managed by International Exposition Co.

Specialized STEARATES OF ZINC CALCIUM ALUMINUM

● As molding speeds climb steadily higher, it becomes more *essential* to provide better lubrication both for the molding material and for the mold itself. For the complete answer to both these problems, it will pay you to turn to Metasap. For, in addition to giving worry-free lubrication, Metasap Metallic Soaps supply a very desirable plasticizing effect. For further information write.

METASAP CHEMICAL COMPANY

PALMITATES
STEARATES
of ALUMINUM, CALCIUM, LEAD, ZINC

Harrison, N. J., Boston, Los Angeles, Chicago, Cedartown, Ga.

ORGANIC PEROXIDES

CATALYSTS FOR POLYMERIZATIONS
DRYING ACCELERATORS · OXIDATION AGENTS · BLEACHING AGENTS

LUCIDOL®
(BENZOYL PEROXIDE)

LUPERCO®
(PEROXIDE COMPOUNDS)

ALPEROX®C
(TECHNICAL LAUROYL PEROXIDE)

SPECIAL ORGANIC PEROXIDES

® REGISTERED TRADEMARK

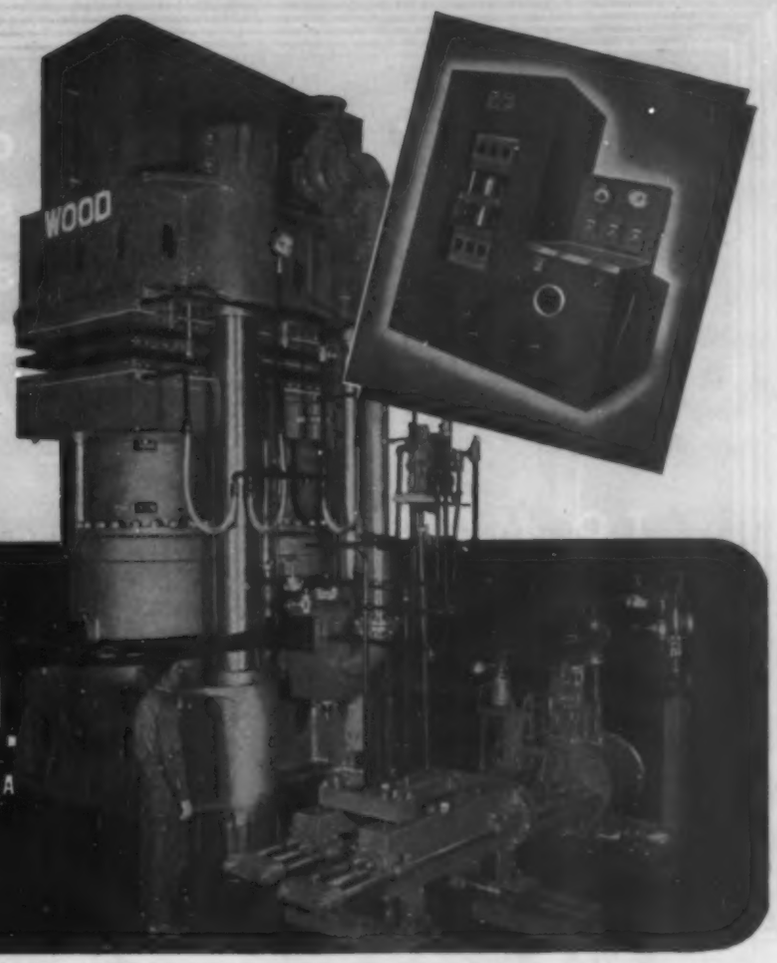
TRADE MARK

LUCIDOL CORPORATION
BUFFALO (5) N. Y.

HYDRAULIC PRESSES FOR EVERY NEED...

From small laboratory presses to massive production units, the R. D. Wood Company designs and builds hydraulic presses to meet every requirement. Typical of variety are the 570-ton Laboratory Press with electrically heated platens shown in inset, and the 3450-ton Hard Board Press with steam heated platens.

The Wood engineering department stands ready at all times for consultation on your hydraulic press problems.



HYDRAULIC PRESSES FOR EVERY PURPOSE

R. D. WOOD CO.

PHILADELPHIA · PENNSYLVANIA

Plastics SCRAP WILL HELP WIN THIS WAR

Plastics are strategic materials—we make it our specialty to conserve them by salvaging all scrap and rejects.

We sell reground molding materials of all kinds and colors to substitute and save virgin molding powder.

We buy scrap and rejects at fair prices and guarantee grinding if desired.

Complete custom service: We regrind, remove all metals, sift and separate, and reclaim contaminated plastics materials.

Cellulose Acetate, Butyrate, Polystyrene, Methyl Methacrylate, Vinyl Resins, etc.

A. BAMBERGER

Plastics Molding Materials

109 SOUTH 5th STREET BROOKLYN, N. Y.

Cable: Chemprod — Telephone: EVergreen 7-3887

Wanted!

WILL PAY CASH-
ANY QUANTITY

CELLULOSE ACETATE
POLYSTYRENE
BEETLE
BAKELITE
AND SCRAP

TO MOULDERS: We are prepared to place quantity orders for long and continuous runs of lipstick containers, rouge boxes, etc., to be made from our own moulds.

HARRY BRODER

CREATOR AND DISTRIBUTOR OF COSMETIC CONTAINERS

5 EAST 47th STREET, NEW YORK, N. Y. • PL 8-0520

DO YOU KNOW . . .

All of the Advantages of Infra-Red Ray Drying with **NALCO DRITHERM**

Carbon Filament Lamps?

Remove Moisture from Plastics Quickly and Cheaply with Nalco Infra-Red Lamps





Use Nalco Dritherm Lamps for efficient results . . . available in Inside-Silvered (self-reflecting) or clear glass types.

Learn all of the advantages of the Infra-Red process for plastic dehydration.

Write for your free copy of "Drying Problems Made Easy" today.





Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.

Sides dropped to show arrangement of Infra-Red light bank and materials passing under light conveyor belt.

North American Electric Lamp Co.
1012 Tyler Street St. Louis 6, Missouri

WANTED

Will purchase outright small or medium size injection molding plant with or without tool room. Replies from any location will be welcome and will be held in strictest confidence.

Reply
Box 852, Modern Plastics

All classified advertising payable in advance of publication. Minimum, $5.00 (up to 60 words); in border, $10.00 per inch.

Classified Advertisements

For further information address *Classified Advertising Dept.* MODERN PLASTICS 122 East 42nd St., New York, N. Y.

CHIEF ENGINEER wanted by a large Pennsylvania custom injection plastic molder. Must have successful record in injection plastic mold designing, molding technique, and related qualifications. Production and development projects included in duties. General engineering knowledge required. Highest salary for right man. Our men know of this advertisement. All replies will be treated confidentially. Reply Box 737, Modern Plastics.

MOLDS WANTED: Will purchase injection molds for Toys, Hardware, Housewares Articles or Novelties—Also Radio Knobs, Grills, Etc. Send sample part if possible and description of mold. Will give bank references, James Specialty Co., 1722 W. Arcade Pl., Chicago, Ill.

ORGANIC DEVELOPMENT CHEMIST: An excellent opportunity for Organic Chemist or Chemical Engineer with organic background and M.A. or Ph.D. degree to do original development in application work in field of synthetic resins. Must have initiative, imagination, and be able to do creative work. State experience and salary desired. Reply Box 833, Modern Plastics.

CHEMIST—FOR NEW FIELD

Chemist to take charge of wood plastic molding department and set up experimental laboratory. Plastic chemistry experience desirable. Write age, background, draft status.

Briarwood Corp., 2810 Superior Avenue, Cleveland, Ohio

WANTED: SALESMAN WITH EXPERIENCE SELLING COTTON AND RAYON FLOCKS TO THE PLASTIC TRADE.
CELLUSUEDE PRODUCTS, INC.
ROCKFORD, ILLINOIS

"FOR SALE: THREE C. & Y. FLOCK CUTTERS, REBUILT LIKE NEW, ALL KNIVES BRAND NEW, PRICE $500.00 EACH. THESE CUTTERS ESPECIALLY DESIGNED FOR MAKING COTTON FLOCKS FOR PLASTIC COMPOUNDING." BOX No. 850.

WANTED: PLASTIC SCRAP OR REJECTS in any form, Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP or rejects in any form, including Acetate, Butyrate, Styrene, Acrylic and Vinyl Resin materials. Submit samples and details of quantities, grades and color for our quotations. Reply Box 508, Modern Plastics.

FOR SALE: 2 W. S. Hydraulic Presses, 12" x 12", 7½" ram; 15" x 15", 8½" ram; 24" x 21", 8" ram. Robertson 13" x 16", 8" ram. 400 Ton Hydraulic Extrusion Press. 80 Ton Hydr. Baler. W. & P. 150 gal. jacketed Mixer. Large stocks of Hydraulic Presses, Pumps, and Accumulators, Mixers, Grinders, Pulverizers, Gas Boilers, etc. Send us your inquiries. We also buy your surplus machinery. Stein Equipment Co., 426 Broome St., New York City.

FOR SALE: 4—Farrel Birmingham Hydraulic Presses, 24 x 24, with 12" ram; 1—W. S. 15" x 18" Hydraulic Press, 10" ram; 1—14" x 24" Press, 9" ram; 9—24" x 55" steel cored Heating Platens; 4—W. & P. Mixers; 1—Elms Hydraulic Pump, 6.5 GPM at 7500# pressure PSI. Adamson 6" Tuber; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box No. 447, Modern Plastics.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

FOR SALE: One Southwark 225 ton Inverted Press with pushbacks. Reply Box 512, Modern Plastics.

PLASTIC MANUFACTURES

A well known sales agent with 5th Ave. show room selling major chain stores and war industries is interested in contacting manufactures desirous of steady outlet for their products. Also have several staple numbers to submit for volume production. Excellent opportunity present and post war distribution. Financial assistance available.

Brandeo Inc. 303 5th Ave. N. Y. C.

"Registered patent agent with extensive experience in the manufacture and fabrication of cellulose derivative and synthetic resin plastics wishes part time connection on the West Coast. Box 851."

Wanted: A practical plastics man experienced in low pressure laminates—as Foreman of Molding Department—including Bag Molding, laminates and tube production. Box 853, Modern Plastics.

Capable man, age 40, wishes to break into sales end of plastics. Having paper and paper converting experience. Willing to undergo period of training. Box 854, Modern Plastics.

WANTED

Man with minimum of one year experience in molding room, or engineering department of injection molding concern, to do sales work on salary basis, for an established Mid-Western concern.

Men with plastic sales experience may also apply. Box 862 Modern Plastics.

WANTED

Salesman with past experience with good injection molding concern, wanted to travel as direct representative for reputable established Mid-Western concern, good salary and opportunities for advancement.

Box 863, Modern Plastics.

FOR SALE

15,000 lbs. Ground Lucite (acrylic resin). Samples and price forwarded on request.

Jos. H. Meyer Bros.
220—25th Street
Brooklyn, N. Y.

"Salesman, several territories available with firm making low pressure plastics primarily for aviation industry. Right man can establish himself permanently." Box 855, Modern Plastics.

NON ESSENTIAL ITEMS for after war use. We will buy moulds for toys and novelties. Reply Box 827, Modern Plastics.

"WANTED—Sales Engineers with offices in Bridgeport and Boston covering New England territory for the past 12 years wish to represent manufacturer of injection and compression moldings.
Ability to develop post war items as well as to obtain prime and subcontract defense work. Executive with well known molder of plastics 1923–1931." Box 856, Modern Plastics.

"Interested in buying or merchandising plastic material suitable as substitute for sole leather for shoes. Fairly good materials now being offered the shoe trade but plenty of room for equal or improved quality. Could furnish sample to interested party. This material now being offered in sheet form. This product, if developed properly, should be a permanent and quantity seller." Box 857, Modern Plastics.

WANTED: New or used Hydraulic Presses for plastic compression moulding and injection machines for plastic moulding, also thermosetting or thermo plastic powder scrap. Simplex Tool & Die Corporation, 230 Fifth Ave., New York 1, N. Y.

POSITION WANTED: CHEMIST ABLE TO SEPARATE AND SALVAGE CONTAMINATED GRANULES, POWDER, ETC., OF PLASTICS MATERIALS WANTS POSITION. Reply, Box 858, Modern Plastics.

PRESSES WANTED

Hydraulic or toggle, 14" x 14" platens; at least 30 ton pressure on hydraulics, wanted by phonograph record manufacturer. Box 859, Modern Plastics.

TOOLMAKER AND MOLD DESIGNER

We want a competent and ingenious man who can design and construct plastic molds. Gorton machine available. Location Pacific Northwest. Excellent post-war prospects. Salary commensurate with qualifications. Reply Box 860, Modern Plastics.

PLASTIC POWDER WANTED!

Large quantities of cellulose acetate in red, ivory, black, green and delph blue in medium flow, comparable to Tenite I. Also can use large quantities of acetate butyrate in ivory and black, comparable to Tenite II.

Pacific Plastic & Mfg. Co.
4565 Exposition Blvd.,
Los Angeles, 16, California

URGENT

NEED ACETATE MOLDERS WITH FACILITIES FOR MOLDING FRAMES FOR SUN GLASSES.

Large Quantities on
High Priority Rating
Box No. 865, Modern Plastics

Thermosetting material manufacturer seeking technical service engineer with thorough knowledge of molding and mold design. Must be free to travel. Responsible and permanent position.
Write giving complete details of background, draft status, education, age, salary range. Box 861, Modern Plastics.

RESEARCH & DEVELOPMENT: Opening with well established manufacturer of Packaging supplies—an essential industry—for person with thorough scientific training and knowledge of Plastics, resins, gums, & waxes. Understanding of problems of food and pharmaceutical packaging desirable. Creative intelligence and capacity for independent research essential. Write stating age, education, experience, salary expected." Box 864, Modern Plastics.

IS THIS MAN FOR YOU?

I have been a successful sales executive and salesman for 20 years, in the advertising field. Now I want to get into Plastics because I think it has a tremendous future. I don't want just a job—I have one—but offer my experience and ability to a solid concern that needs help in formulating and executing a real distribution program, now and post-war. Married, out of draft. Can furnish first-rate references. Box 866, Modern Plastics.

ENGINEER WANTED

Chemical engineer experienced in plastic compounding. Knowledge of rubber compounding desirable but not essential. Permanent position. Eastern firm. Write stating experience, training, age and salary expected. Reply Box 815, Modern Plastics.

AUSTRALIA CALLING!

WE HAVE THE ORGANIZATION
if you have the goods.

Australian company with ten years technical experience in Plastics wants to co-operate with American manufacturers of moulding compounds and raw materials for the Plastics Industry, on sole distribution basis. Very interested in synthetic fibres, yarns and textiles. Don't allow present difficulties and restrictions to prevent you from planning NOW for future Peacetime business.

apply "AUSTRALIA CALLING"
Box 705

MODERN PLASTICS

122 East 42nd St. New York

(Replies forwarded out to Australia for attention)

Index To Advertisements

Allied Products Corp. 58
Aluminum Company of America 51
American Cyanamid Co. 98, 99
American Insulator Corp. 159
American Photocopy Equipment Co. 172
American Screw Co. 137
Atlas Moulded Products Co. 56
Atlas Valve Co. 159
Auburn Button Works 149
Australia Calling 182
Bakelite Corp. Inside Back Cover
Baldwin Locomotive Works 12
Ball & Jewell 172
Bamberger, A. 179
Bardwell & McAlister, Inc. 155
Bead Chain Mfg. Company 50
Becker, Moore & Co., Inc. 166
Boonton Molding Co. 31
Brilhart, Arnold Co. 40
Bristol Co., The 137
Broder, Harry 180
Cambridge Instrument Co., Inc. 174
Carpenter Steel Co., The 169
Carrier Corporation 10
Carter Products Co. 174
Carver, Fred S. 168, 169
Catalin Corp. 3
Celanese Celluloid Corp. 9
Central Screw Co. 137
Chandler Products Corp. 137
Chicago Molded Products Corp. 62
Claremont Waste Mfg. Co. 161
Clark, Robert H. 177
Classified 181, 182
Colton, Arthur Co. 156
Columbia Protektosite Co., Inc. 127
Consolidated Molded Products Corp. 39
Consolidated Textile Co., Inc. 156
Continental Diamond Fibre Co. 37
Continental Screw Co. 137
Corbin Screw Corp., The 137
Creative Printmakers Group 176
Cruver Mfg. Co. 61
Curran & Barry 173
Despatch Oven 161
Detroit Macoid Corp. 147
Detroit Mold Engineering 162
Detroit Wax Paper Co. 165
Diemolding Corporation 176
Dillon-Beck Mfg. Co. 175
Dow Chemical Co. 123
du Pont de Nemours, E. I. & Co., Inc. Plastics Dept. 7
du Pont de Nemours, E. I. & Co., Inc. Electrochemicals Dept. 157
Durez Plastics & Chemicals Inc. Inside Front Cover
Duro Tools 170
Eagle Tool & Machine Co. 159
Edge Moor Iron Works 167
Electric Auto-Lite Co., The 65
Electrix Corporation 166
Elmes Engineering Works of American Steel Foundries 25
Erie Resistor Corp. 24
Exposition Chemical Industries 178
Extruded Plastics, Inc. 54
Federal Telephone & Radio Corp. 11
Felsenthal & Sons, G. 180
Formica Insulation 131
Fortney Mfg. Co. 160
Franklin Plastics Div. 155
French Oil Machinery Co. 167
General Electric Co. Back Cover
General Industries Co. 139
Gering Products, Inc. 157
Girdler Corp. 36
Great American Plastics Co., The 113
Harper Co., H. M., The 137
Hassal Inc., John 175
Hercules Powder Co., Inc. 23, 45
Hetherington & Berner, Inc. 166
Heyden Chemical Co. 164
Hodgman Rubber Co. 156
Hydraulic Press Mfg. Co. 117
Ideal Plastics Corp. 158
Industrial Hard Chromium Co. 29
Industrial Synthetics Corp. 125
Insulation Manufacturing Co. 165
International Molded Plastics, Inc. 174
International Screw Co. 137
Keyes-Fibre Co. 14
Kingsley Gold Stamping Machine Co. 174
Kuhn & Jacob Molding & Tool Co. 161
Kurz-Kasch, Inc. 22
Laboratory Specialties, Inc. 158
Lamson & Sessions Co., The 137
Lane, J. H. Co., Inc. 160
Lucidol Corp. 178
Mack Molding Co. 171
Markem Machine Co. 162
McAleer Mfg. Co. 121
Mearl Corp., The 160
Mears-Kane-Ofeldt, Inc. 160
Mercer-Robinson Co., Inc. 168
Metal Specialties Co. 26
Metasap Chemical Co. 178
Michigan Molded Plastics, Inc. 167
Midland Die & Engraving Co. 129
Mills, Elmer E. Corp. 13
Minneapolis Plastic Company 168
Molded Products Co. 44
Monsanto Chemical Co. 66
Mosinee Paper Mills Co. 102
Mt. Vernon-Woodberry Mills, Inc. 52
Muehlstein, H. & Co., Inc. 173
Munising Paper Co. 55
National Rubber Machinery Co. 5
National Screw Mfg. Co., The 68, 137
National Vulcanized Fibre Co. 63
Newark Die Company 166
New England Screw Co. 163
New York Air Brake Co. 48
Niacet Chemicals Corp. 165
Nixon Nitration Works 115
North American Electric Lamp Co. 180
North American Phillips 34
Northern Industrial Chemical Co. 171
Norton Laboratories, Inc. 28
Olsen Testing Machine Co., Tinius 53
Owens-Illinois Glass Co. 141
Parker, Charles, Co., The 137
Parker-Kalon Co. 30, 137
Pawtucket Screw Co. 137
Peerless Roll Leaf Co. 38
Pheoll Manufacturing Co. 137
Phillips Screw Manufacturers 137
Pittsburgh Steel Co. 153
Plaskon Division 94, 95
Plastic Manufacturers, Inc. 163
Plastic Molding Corp. 170
Plastic Industries Technical Institute 64
Plastimold, Inc. 173
Plax Corporation 59
Pyro Plastics Co. 135
Racine Tool & Machine Co. 171
Rayon Processing Co. of R. I. 20
Reading Screw Co. 137
Reed-Prentice Corp. 8
Reilly Tar & Chemical Co. 49
Reynolds Molded Plastics 16
Richardson Co. 6
Riegel Paper Corp. 43
Rodgers Hydraulic, Inc. 145
Rogan Brothers 177
Rohm & Haas Co. 27
Royle, John & Sons 67
Russell Burdsall & Ward Bolt & Nut Co. 137
Sandee Manufacturing Co. 35
Sav-way Industries 18, 19
Scovill Manufacturing Co. 137
Shakeproof, Inc. 33, 137
Shaw Insulator Co. 151
Sinko Tool & Mfg. Co. 32
Society of the Plastics Industry 133
Southington Hardware Mfg. Co., The 137
Standard Tool Co. 163
Stanley Works, R. L. Carter Div. 158
Sterling Tool Products 46
Stricker-Brunhuber Co. 177
Synthane Corporation 41, 42
Taylor-Fibre Co. 143
Tech-Art Plastics Co. 119
Tennessee Eastman Co. 101
Thropp, Wm. R., & Sons Co. 176
Timken Roller Bearings Co. 21
Tinnerman Products, Inc. 57
Trav-ler Karenola Radio & Television Corp. 170
Union Carbide & Carbon Corp. Inside Back Cover
United States Rubber Co. 60
United States Testing Co., Inc. 47
Universal Plastics Corp. 172
Waterbury Button Co., The 164
Watson-Stillman Co. 17
Westinghouse Electric & Mfg. Co. 15
Whitney Screw Corp. 137
Wood, R. D., Co. 179

Modern Plastics Published by MODERN PLASTICS, INC. 122 E. 42nd St. NEW YORK 17, N. Y.

BAKELITE CORPORATION ANNOUNCES

Special Wartime Plastics that Conserve Phenol

★

SEVEN NEW "BAKELITE" PHENOLIC MOLDING MATERIALS
ADAPTABLE TO MANY ESSENTIAL PRODUCTS

IN keeping with its wartime policy of conserving critical chemicals wherever possible, without undue sacrifice of quality, Bakelite Corporation announces the development of several special phenolic molding materials that employ to a larger extent the more readily available raw materials. Suitable for many applications where it is not necessary to meet extremely rigid government specifications, these new phenolics help considerably to extend the current supply of phenol, and permit the greater use of this vital chemical for military and naval plastic needs.

For the present there are seven of these *conservation* molding plastics. BM-16044 Brown and BM-16325 Black are offered for everyday applications that formerly required general-purpose phenolics. BM-16749 Black, BM-16750 Brown, BM-16785 Black, and BM-16786 Brown have been developed primarily for bottle caps and closures. And BM-16499 is suitable for jobs that normally called for a high impact-resistant material, such as BM-3510.

Many products now formed from the more critical types of BAKELITE Phenolics can be satisfactorily fabricated, with adequate performance characteristics, from the new *conservation* molding plastics. For complete information, and assistance in adapting these phenolics to essential needs, write Department 15.

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation

UCC

30 East 42nd Street, New York 17, N.Y.

BAKELITE

The word "Bakelite" and the identifying products Symbol are registered trade-marks of Bakelite Corporation

PLASTICS HEADQUARTERS

PLASTICIAN *

Perhaps molded laminated plastics is the answe
to your problem. Cold molded plastics may be th
best bet. Are you pondering between a choice
compression molded urea and injection molde
methacrylate? The Plastics Divisions of the Gener
Electric Company manufactures compression, i
jection, transfer and cold molded plastics. They al
mold and fabricate parts of laminated shee
tubes and rods; and since the beginning of war, G-
has been low pressure molding large structur
pieces. Because General Electric manufactures pla
tics by all these methods, you can be sure yo
application is made the proper way from th
proper material.

G-E engineers and designers are *your* enginee
and designers. These plasticians will tell you if
combination of metals and plastics is the answer
your problem. They will frankly tell you if the colo
ful ureas, the sleek phenolics and the versati
thermoplastics, or the heat resisting cold molde
plastics are not for you. Let these plasticians hel
you, write Section A-10, One Plastics Avenu
Pittsfield, Mass.

*192,000 employees of the General Electric Com
pany are on their jobs producing more goods an
buying over a million dollars of War Bonds ever
week to hasten victory.*

*Listen to the news on the WORLD TODAY eac
week-day evening, CBS, 6:45 P.M., E.W.T. O
Sunday, listen to the HOUR OF CHARM o
NBC, 10:00 P.M., E.W.T.*

PLASTICS DIVISION
GENERAL ELECTRIC

* One Who KNOWS Plastics